HUB POWER AND HUB(USES): POWER DYNAMICS IN PLATFORM ECOSYSTEMS

RAZ AGRANAT
MICHAL S. GAL*

Forthcoming, Antitrust Law Journal (2026)

---

* Raz Agranat is a JSD Candidate at the University of Chicago Law School, in his last year of studies, and a member of the International Association of Competition Law Scholars (ASCOLA). Michal S. Gal (LL.B., LL.M., S.J.D) is Professor, University of Haifa Faculty of Law and Honorary Doctor, University of Zurich, and the past president of ASCOLA (2016–2023). Our sincere thanks to Baruch Barzel, Omri Ben-Shahar, Inge Graef, Giorgio Monti, John Newman, Stephen Ross, D. Daniel Sokol, participants of ASCOLA and CRESSE conferences and Tilburg Center for Law and Economics (TILEC) workshop on Economic Governance of Social Media, and the two anonymous reviewers for superb comments, as well as to Noy Benisti, Tomer Stern and Almog Zackry for excellent research assistance. Any mistakes or omissions remain the authors'.

INTRODUCTION

Magnus Carlsen, the world's premier chess player and arguably the greatest of all time, commands a global audience of millions who scrutinize his every move. In a professional tournament in 2022, Carlsen faced Hans Niemann, a lesser-known and lower-ranked opponent. In a shocking upset, Carlsen suffered a crushing defeat in the match.[1] Although he lacked direct evidence to support his claim, Carlsen accused Niemann of cheating by using an AI-powered chess engine. He then took the dramatic step of refusing to participate in tournaments featuring Niemann.[2] Just a day into this controversy, Chess.com, the world's largest online chess platform, banned Niemann from accessing their site.[3] The platform cited indirect evidence of prior misconduct as justification for their decision, although this evidence was notably

---

[1] With his stunning win, Neimann ended Carlsen's fifty-three-game unbeaten streak in classical chess with white, which had lasted for more than two years. Niemann is one of only five players in five years to defeat Carlsen while he was playing the white pieces, with three of Carlsen's losses occurring before 2018. CHESS.COM, *Hans Niemann Report*, 18 (Oct 2022), https://www.chess.com/blog/CHESScom/hans-niemann-report (hereinafter "Chess.com Report"); LICHESS, *Magnus Carlsen Losses in Classical Chess 2011–2023*, https://lichess.org/study/ptWMvZDH/GkOeAj9l. Niemann was notably the lowest-rated player at the tournament, and ranked approximately fortieth among the top players at the time, well below the other players who defeated Carlsen. Greg, Keener, *The Chess World Isn't Ready for a Cheating Scandal*, N.Y. TIMES (Sep 13, 2022), https://www.nytimes.com/2022/09/13/crosswords/hans-niemann-magnus-carlsen-cheating-accusation.html; INTERNATIONAL CHESS FEDERATION (FIDE), *Top 100 Players November 2022 – Archive*, https://ratings.fide.com/top-arc.phtml?cod=713. Neimann later commented "[Carlsen] was so demoralized because he's losing to such an idiot like me . . . . It must be embarrassing for the world champion to lose to me." GOTHAMCHESS, *Hans Niemann Beats Magnus Carlsen*, YOUTUBE, at 25:10 (Sep 5, 2022), https://www.youtube.com/watch?v=GSLM1K6O6aU.

[2] *Niemann v. Carlsen*, No. 4:22-cv-01110-AGF, 2023 WL 4198227, at *4–6 (E.D. Mo. 2023).

[3] *Id.*

unrelated to the tournament in question.[4] This sequence of events sent shockwaves through the chess community, raising questions about fair play, the power dynamics within the sport, and the role of digital platforms in arbitrating disputes. It also triggered an antitrust lawsuit by Niemann against Carlsen, Chess.com, and others.[5] Although the lawsuit was eventually dismissed,[6] our analysis shows that the case possessed greater substantive merit than the court's limited understanding of network dynamics suggested.

Chess.com's swift alignment with Carlsen's unsubstantiated accusations offers an instructive case study of the asymmetric influence that certain participants—such as Carlsen—can wield within platforms by virtue of their high connectivity and centrality in the platform's network topology.[7] These participants, known as *hubs* in network science literature,[8] possess orders of magnitude more connections than the average participant. As a result, they enjoy significantly greater influence over platform governance decisions and can markedly shape the potential trajectories of other market participants. This phenomenon, which we term *hub power*, represents a distinct form of influence that arises from structural positioning within networked environments, rather than from traditional market dominance or formal authority. It is a nuanced form of power that warrants careful examination and carries profound implications for our understanding of competitive dynamics in platform economies.

Platform competition has captivated antitrust academics, decision-makers, and industry leaders alike, spurring groundbreaking research[9] and

---

[4] While Chess.com stated that it was never pressured by Carlsen to remove Niemann from the platform or disinvite him from organized tournaments, it cited "Magnus' unprecedented withdrawal" as a reason for its response. Chess.com Report, *supra* note 1, at 2–4.

[5] Niemann attempted to sue Carlsen and Chess.com, including on antitrust grounds, but his lawsuit was ultimately dismissed. The case was subsequently settled. *Niemann*, 2023 WL 4198227; Andrew Beaton & Joshua Robinson, *The Chess Cheating Scandal Ends with an Uncomfortable Handshake*, WALL ST. J. (Aug. 28, 2023), https://www.wsj.com/sports/chess-cheating-magnus-carlsen-hans-niemann-be3b9c5; *see also infra* subpart III.1.B.

[6] *Id*.

[7] The term "topology" refers to the arrangement of nodes and links in the network, that is, the network architecture.

[8] See *infra* subpart II.1.

[9] *See, e.g.* Howard A. Shelanski & J. Gregory Sidak, *Antitrust Divestiture in Network Industries*, 68 U. CHI. L. REV. 1 (2001); Erik Hovenkamp, *Platform Antitrust*, 44 J. CORP. L. 713, 714–15 (2019); Herbert Hovenkamp, *Antitrust and Platform Monopoly*, 130 YALE L. J. 1953 (2021); Daniel A. Crane, *Defining Relevant Markets in Digital Ecosystems*, 7 J.L. & INNOVATION 10 (2024).

landmark cases involving some of history's most successful firms.[10] Yet while platforms have been thoroughly studied,[11] the competitive dynamics *within* platforms remain largely unexplored.[12] Crucially, although hub power is a pervasive and impactful force within many platform ecosystems, existing antitrust scholarship and case law fail to account for this phenomenon, mistakenly assuming that all platform participants are equally integral to the platform's operation.[13]

Furthermore, as demonstrated by the examples analyzed throughout this article, courts and agencies—lacking a robust framework to evaluate the competitive implications of hub power and constrained by the limitations of the current legal prohibitions—often fail to find antitrust liability when confronted with instances in which hubs have exercised their power to inflict significant competitive harm.[14] To illustrate, both Magnus Carlsen and platform behemoth Chess.com avoided antitrust liability despite inflicting grave harm on Niemann.[15]

This article endeavors to address this lacuna. Drawing on insights from microeconomics and network science—an emerging, cutting-edge scientific

---

[10] *See, e.g.*, *United States v. Google LLC*, No. 1:20-cv-03010-APM (finding Google liable for monopolization under Section 2 of the Sherman Act) (D.D.C. 2024); Complaint, *FTC v. Meta Platforms, Inc.*, No. 1:20-cv-03590 (D.D.C. Dec. 8, 2020); Complaint, *United States v. Google LLC*, No. 1:20-cv-03010-APM (D.D.C. Oct. 20, 2020);; Complaint, United States v. Apple Inc., No. 2:24-cv-04055 (D.N.J. Mar. 21, 2024).

[11] For an overview of the research, see Hsing Kenneth Cheng, D. Daniel Sokol & Xinyu Zang, *The Rise of Empirical Online Platform Research in the New Millennium*, 33(J. ECON. & MGMT. STRATEGY 416 (2024).

[12] To our knowledge, antitrust's examination of intra-platform dynamics has not advanced beyond a simplistic conceptual model of feedback effects in two-sided platforms. *See* David S. Evans & Richard Schmalensee, *Markets with Two-Sided Platforms*, 1 ISSUES COMP. L. & POL'Y 667, 674–75 (2008); David S. Evans & Michael Noel, *Defining Antitrust Markets When Firms Operate Two-Sided Markets*, 2005 COLUM BUS. REV. 667, 680–81. This model has been invoked by the U.S. Supreme Court in *Ohio v. Am. Express Co.*, 138 S. Ct. 2274, 2280 (2018), and has featured in subsequent scholarship. *See e.g.*, Herbert Hovenkamp, *Platforms and the Rule of Reason: The American Express Case*, 2019 COLUM BUS. REV. 38. While foundational, this theoretical framework offers little insight into the nuanced power relationships and the resulting competitive dynamics that emerge from within complex platform ecosystems.

[13] *See* Raz Agranat & Michal Gal, *The Microsoft Formula for Network Effects: Do Strong Network Effects Necessarily Lead to Winner-Takes-It-All?* (2025), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5424114.

[14] See examples analyzed in this article, in particular Part III *infra*.

[15] *See* Part IV *infra*.

discipline that explores the properties of complex networks[16]—we first offer a novel analytical framework for determining the extent of hub power, identifying four key determinants (Part II). The analysis yields two significant insights. First, hubs can exert disproportionate control over interactions and value creation within platform ecosystems. Accordingly, determining the effects of platforms on competition and social welfare requires a nuanced examination of inter- and intra-platform power dynamics. Second, conventional market power metrics may fail to adequately capture a hub's actual influence, as hubs can leverage interactions on and with the platform to amplify their power far beyond what their share of interactions on the (rival) platform(s) suggests. While some decisionmakers have incorporated rudimentary assessments of network dynamics into their decisions,[17] a thorough analysis grounded in contemporary network science remains lacking.

We then identify three distinct manifestations of conduct that abuse hub power—what we term hub(use):[18] unilateral conduct, coordinated action, and unilateral conduct that harnesses aggregate power (Part III). Each has the potential to reduce social welfare through interactions with the platform itself, its participants, and even third parties. Through detailed case studies—spanning e-books, chess, the air travel industry, and social media and streaming platforms—we demonstrate how hub power can fundamentally reshape platform dynamics and outcomes, introducing unique complexities absent in traditional industries. The analysis also shows that network dynamics may blur the lines between unilateral and coordinated conduct that undergird antitrust law. Our analysis provides a systematic framework for reconsidering key aspects of platform governance that have drawn public and academic attention. It also challenges the conventional wisdom that platform power should serve as the sole or primary focus of antitrust.[19] Part IV concludes.

Our analysis is situated within a broader body of research that recognizes the critical role of network dynamics in shaping socio-economic outcomes. For instance, in their study of networked propaganda, Benkler et al. assert that "to understand media and politics, we must understand the entire ecosystem: the outlets and influencers who form networks, the structure of networks, and the flow of information in networks."[20] Some scholars, like Hacohen and Menell, implicitly recognize hub influence in specific contexts such as social

---

[16] ALBERT-LÁSZLÓ BARABÁSI, NETWORK SCIENCE 23–24 (2016).

[17] Agranat & Gal, *supra* note 13, at pp. 6-21.

[18] This term is a wordplay on hub power abuse.

[19] A previous article focused on the pro-competitive effects of hubs for restraining the power of platforms. Raz Agranat, *Uncovering the Role of Hubs: A Network Science Perspective on Platform Competition*, 29 STAN. J. L. BUS. & FIN. 212 (2024).

[20] YOCHAI BENKLER ET AL., NETWORK PROPAGANDA: MANIPULATION DISINFORMATION AND RADICALIZATION IN AMERICAN POLITICS 45 (2018).

media influencers.[21] However, those studies lack a robust methodology for identifying and examining the full scope of hub power within platform ecosystems, as well as the nuanced ways in which that power manifests. Moreover, current scholarly and judicial approaches often rely on oversimplified assumptions about platform dynamics.[22] While such approaches may suffice in specific contexts, this reductive analysis risks yielding suboptimal regulatory interventions that fail to address the underlying systemic complexities. For example, reductive approaches might miscalculate the ability of market forces to constrain hub power. This article addresses these theoretical and methodological gaps by developing a more nuanced framework for analyzing hub power in contemporary digital platforms. By expanding the discourse on platform governance, we hope that this research will inform policy considerations for fostering vibrant and fair platform ecosystems.

The significance of our contribution stems from the combination of two factors. First, platforms have become ubiquitous and influential in modern life. Contemporary platforms not only serve as catalysts for economic activity but also profoundly shape our daily interactions and societal structures. Second, hubs operate on a remarkably wide array of platforms that digitally connect people across various domains—from social media and music and video streaming to e-commerce. Accordingly, hub power is a pervasive phenomenon that increases the potential for hub(use). To illustrate the pressing need to account for hub power, consider how a hub on a streaming platform can shape user exposure by influencing the platform's recommendation system or content moderation policies, thereby boosting the visibility of its content at the expense of others. These dynamics present novel challenges for antitrust.[23] Addressing them requires a deeper understanding of power relations within platform ecosystems and the development of legal rules to counterbalance disproportionate influence.

I. HUB POWER

This part introduces a conceptual framework for evaluating the existence and magnitude of hub power. This conceptualization serves two key purposes: illuminating an understudied phenomenon with far-reaching economic and legal implications, and offering a methodology for evaluating hub power. As market power is a necessary prerequisite for finding anticompetitive

---

[21] *See generally* Uri Y. Hacohen & Peter Menell, *Unjust Endorsement*, U. Ill. L. Rev. (forthcoming 2025), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5174250 .

[22] Agranat & Gal, *supra* note 17, at pp. 6-21.

[23] *See* discussion in Part III *infra*.

conduct, this methodology also provides a critical foundation for the hub(use) analysis addressed in Part III.

Our framework proposes four key determinants for evaluating hub power: hub attractiveness (measuring link acquisition capability), platform dependence (assessing the platform's vulnerability to hub departure), switching feasibility (evaluating the hub's ability to switch platforms or cease operations altogether), and countervailing power (gauging other nodes' resistance capabilities). The methodology combines network-science analysis for the first two factors with conventional microeconomic approaches for the latter two, providing a comprehensive analytical framework for understanding hub power dynamics. We then briefly sketch how hub power should affect the analysis of platform power.

A. On Nodes, Links, and Hubs

Viewed through the lens of network science, all platforms are essentially networks consisting of "nodes" and "links", representing the platform participants[24] and the interactions among them on the platform, respectively.[25] For instance, in Facebook's social media platform, nodes can represent user profiles and content creator pages, while links can represent "friend" or "follower" relationships. Analogously, the nodes of streaming platforms can represent viewers and content creators, while links represent followers.

In many platforms, nodes exhibit significant disparities in their *degree*—network science's term for a node's number of their links.[26] While the vast majority of nodes are low-degree, meaning they possess only a modest number of links, a small subset amasses orders of magnitude more connections, thereby forming high-degree nodes (i.e. hubs).[27] For instance, the average Facebook user has approximately 350 "friends," a far cry from Taylor Swift's

[24] For simplicity, in this article we refer to platform participants as "nodes." The choice of which entities and activities to represent as nodes and which as links may in fact be far from trivial, depending on the nature of the specific problem at hand. Barabási, *supra* note 16, at 45–46. For example, nodes on a social media platform can represent content created by users.

[25] Deciding what links represent is equally non-trivial. For example, a link can be defined based on a single interaction or on a number of interactions over a given period. Network science can address the intensity of interactions between platform participants by assigning weights to links. *Id.* at 51–54.

[26] *Id.* at 47–48.

[27] *Id.* at 119–20.

staggering 80 million followers.[28] These high-degree hubs, the focal point of this article, play a pivotal role in shaping the competitive dynamics within platforms and in determining their overall robustness.

Hubs emerge from the interplay between two simple mechanisms—growth and preferential attachment.[29] *Growth* refers to the continuous addition of new nodes to the network. For example, since Mark Zuckerberg created the first Facebook profile in 2004, Facebook's network has grown to an astounding size through the continuous addition of new profiles and pages.[30] *Preferential attachment* refers to the tendency of newly added nodes in a network to form links with high-degree nodes rather than with those that have fewer connections.[31] For example, the typical new Facebook user is more likely to follow Cristiano Ronaldo—the world-famous soccer star—than the typical Facebook user. Preferential attachment generates a "rich-get-richer" dynamic, conferring advantageous link acquisition on more connected nodes, which can ultimately evolve into hubs.[32]

When growth and preferential attachment are combined, a "scale-free" topology emerges, in which a few hubs co-exist alongside many low-degree nodes.[33] Figure 1 depicts the emergence of such a network. At each step, a new node (depicted in white) with two links is added to the network. As these nodes have a preference to connect to more connected nodes, over time some nodes acquire many more links than others.[34]

---

[28] Aaron Smith, *What People Like and Dislike about Facebook*, PEW RSCH. CTR. (Feb. 3, 2014), https://www.pewresearch.org/fact-tank/2014/02/03/what-people-like-dislike-about-facebook/; Facebook Page of Taylor Swift, FACEBOOK, https://www.facebook.com/TaylorSwift

[29] This was demonstrated in the minimal proof-of-concept Barabási–Albert model. Albert-László Barabási & Réka Albert, *Emergence of Scaling in Random Networks*, 286 SCI. 509 (1999); *see also* Barabási, *supra* note 16, at 169–70.

[30] Camelia Zoica, *First 10 People on Facebook: Who Created the First Facebook Accounts?*, HOT IN SOCIAL MEDIA (May 21, 2020), https://hotinsocialmedia.com/the-first-10-people-who-have-made-a-facebook-account/.

[31] Preferential attachment may also underlie other topology-shaping mechanisms, such as adding internal links among existing nodes. BARABÁSI, *supra* note 16, at 217–19.

[32] *Id.* at 170–74.

[33] Scale-free networks are so named because their degree distribution follows a power law and is therefore scale-invariant—that is, the relative proportions of low- and high-degree nodes remain consistent across scale. *Id.* at 122–26.

[34] *Id.* at 169.

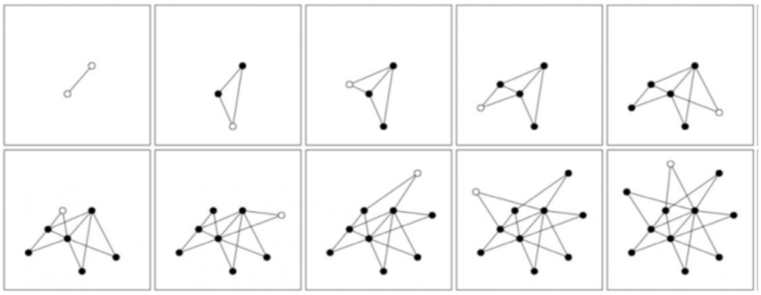

FIGURE 1: EVOLUTION OF A SCALE-FREE NETWORK

Growth and preferential attachment permeate diverse platform ecosystems, facilitating hub proliferation throughout the digital sector.[35] Social media, e-commerce, content-sharing, streaming and gaming are but a few examples of platforms exhibiting hubs.

Platform architecture shapes—and at times restricts—which nodes can connect. The types of participants that hubs link to therefore vary across platforms. In some two-sided platforms, for example, hubs on one side connect exclusively to participants on the other side. E-commerce platforms illustrate this pattern: super-merchants can serve tens of millions of consumers without ever linking to other merchants. In other two-sided platforms, hubs intermediate between participants on one side and the platform itself, and by extension participants on the other side. For example, in e-book platforms, major publishers often aggregate authors, positioning themselves between these authors and the platform, and ultimately, the readers (see Figure 7[36]). In other contexts, hubs connect not only to countless participants on the other side but also to participants on their own side, including other hubs. This can be exemplified by streaming platforms such as Twitch, where prominent streamers broadcast to countless users while also potentially connecting with other streamers through features such as "Twitch Teams" and "Stream Together."[37] Likewise, in social media platforms, hubs may link to various types of participants. For instance, Ronaldo's Facebook Page may be linked both to the profiles of end users and to other Facebook Pages of businesses and other celebrities. However, since most platform participants are typically end users, hub status primarily depends on linking to them.

---

[35] Other mechanisms beyond growth and preferential attachment often shape platform topology, including node deletion, link deletion, and aging. However, these mechanisms typically do not impede hub formation except under extreme conditions. *Id.* at 217–20.

[36] *Infra,* at Part II.B.2.

[37] See *Twitch Teams*, TWITCH, https://help.twitch.tv/s/article/twitch-teams?language=en_US; *Stream Together*, TWITCH, https://help.twitch.tv/s/article/stream-together?language=en_US.

Importantly, network science's conceptualization of hub power captures all these—and other—configurations. Fundamentally, hub status depends on a participant's *degree*, regardless of the *types* of nodes connected to it.

The above analysis also highlights that hub power fundamentally differs from bargaining power of strong suppliers operating in non-networked industries. Bargaining leverage - whether stemming from patent monopolies like a pharmaceutical company's exclusive rights to Tylenol, or from exceptional talent like John Williams, the acclaimed composer behind the scores of countless globally beloved films, including *Star Wars*, *E.T., Schindler's List* and *Harry Potter* - derives from individual attributes: statutory exclusivity, skill, or reputation. In contrast, hub power originates from structural positioning *within the platform's network* topology and functions through network effects. Its power manifests through its capacity to shape the visibility, reputation, content, opportunities and actions of participants – some of whom will never directly interact with the hub. Consider the difference between purchasing Tylenol based on recommendations - a decision ultimately determined by individual experience - and learning a Taylor Swift song you dislike, purely to enable you to join in when it comes up in social interactions. The former reflects personal preference; the latter exemplifies network-driven adoption where connectivity shapes behavior independent of individual assessment. This structural form of influence can prove more durable than conventional market power.

B. Four Main Determinants of Hub Power

The *intra-platform* competitive dynamics can be conceptualized as an interplay of power relationships between a hub and three principal entities: the platform, other hubs, and other nodes. These power dynamics are further modulated by *inter-platform* competition. Figure 2 depicts these interplays graphically, with potential migration paths of low-degree nodes and hubs between rival platforms illustrated by directional arrows. With this intricate interplay in mind, we build on network science and platform economics to identify four critical determinants of hub power within platform ecosystems: hub attractiveness, platform dependence, switching feasibility, and countervailing power. As elaborated in the following sub-part, these determinants should be used by regulators to evaluate a hub's market power and its resultant influence on inter- and intra-platform competitive dynamics. As will be further elaborated, network science provides sophisticated tools that can assist decision-makers in assessing our proposed factors, if sufficient data exists.

Commented [JN1]: Flagging that the text in this figure is too small to read in print.

Commented [JR2R1]: Nick will fix

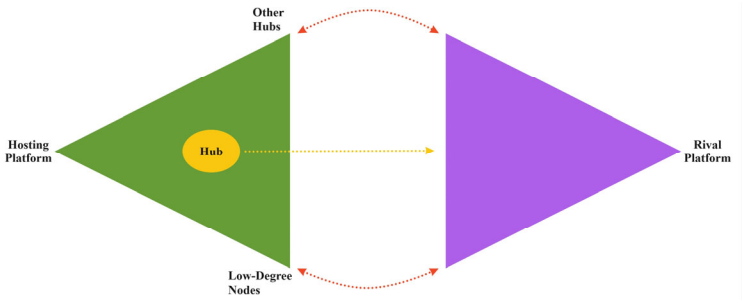

FIGURE 2: POWER RELATIONSHIPS AFFECTING HUB POWER

1. *Hub Attractiveness*

The first factor focuses on the comparative advantage of the hub over other nodes in acquiring links, a trait we label *hub attractiveness*. Hub attractiveness arises from the interplay of two topology-shaping mechanisms: fitness and preferential attachment.

Hubs typically possess a higher degree of *fitness*, a term in network science that denotes a node's intrinsic ability to attract links.[38] To illustrate, Taylor Swift's talent captivates her fandom and, by corollary, boosts her presence on music-streaming and social media platforms. However, what sets Swift apart from other singers with comparable talent who might never reach her level of stardom is the *preferential attachment* mechanism and the associated rich-get-richer phenomenon. This mechanism enables Swift to accumulate links more easily because she already possesses a large number of connections on relevant platforms. Swift's established popularity enhances both the discoverability and the appeal of her songs.[39] Moreover, in some contexts, fitness and preferential attachment augment one another. For instance, individuals tend to form better subjective impressions of songs when they observe that others have enjoyed them.[40] This boost in fitness, in turn, generates an increase in degree, fueling further preferential attachment, fostering a powerful growth dynamic. Recognizing these dynamics helps identify current and

---

[38] *Id.* at 203–05.

[39] Preferential attachment tends to play a greater role than fitness in determining hubs' success. *See, e.g.*, ALBERT-LÁSZLÓ BARABÁSI, THE FORMULA: THE UNIVERSAL LAWS OF SUCCESS 19–24, 31 (2018). For example, Barabási notes that while the "Red Baron" is celebrated as the greatest WWI pilot, nobody remembers René Fonck, a French pilot with a comparable victory count in the same war. The author attributes the difference to preferential attachment dynamics.

[40] Indeed, social influence has been found to have a strong effect on individual song preferences. *See, e.g.*, Matthew J. Salganic & Duncan J. Watts, *Leading the Herd Astray: An Experimental Study of Self-fulfilling Prophecies in an Artificial Cultural Market*, 71 SOC. PSYCH. Q. 338 (2008).

emerging hubs, though this is only a first step—a necessary but not sufficient condition for hub power analysis.

2. *Platform Dependence on the Hub*

The second factor measures the extent to which the platform depends on the hub to maintain network connectivity. All platforms experience node departures, such as Netflix subscribers switching to Hulu or Facebook users leaving social media altogether. When a sufficient number of nodes is removed, the network unravels, breaking apart into disconnected clusters of nodes and rendering the platform unsustainable.[41] The presence of hubs profoundly affects a network's robustness to node removal.

To illustrate this factor's significance, we compare the effects of node removal in two types of networks. Both have the same number of nodes (50) and links (96), but exhibit distinct topologies. Figure 3 depicts a network where all nodes have a comparable number of links and no hubs are present (known as a "random network").[42] Figures 4 and 5 depict a network with a small number of hubs among many low-degree nodes ("scale-free network"). We examine how node removal affects the network's integrity, assessing the interconnectedness of its remaining nodes. For convenience, node size and color intensity correlate with degree *before node removal*, with larger size and darker color indicating higher degree. The numbers on the nodes simply make it easier to track a similar node, and do not correlate with the node's degree. The node's features remain unchanged after node removal, to allow easier visual comparison.

If we attempt to break a random network by gradually removing random nodes, the critical threshold for fragmentation is typically when approximately 60% of nodes are removed.[43] Figure 3 (right-hand panel) illustrates this effect, showing the network fractured into three small clusters and two isolated nodes.

No Nodes Removed	60% of Nodes Randomly Removed

[41] In strict mathematical terms, a network becomes fragmented when its largest remaining cluster—called the *giant connected component* (GCC)—becomes nearly independent of alterations in the overall network size. Our deepest thanks to Prof. Baruch Barzel for this explanation.

[42] BARABÁSI, *supra* note 16, at 74–77.

[43] This threshold depends on network density. *Id.* at 280.

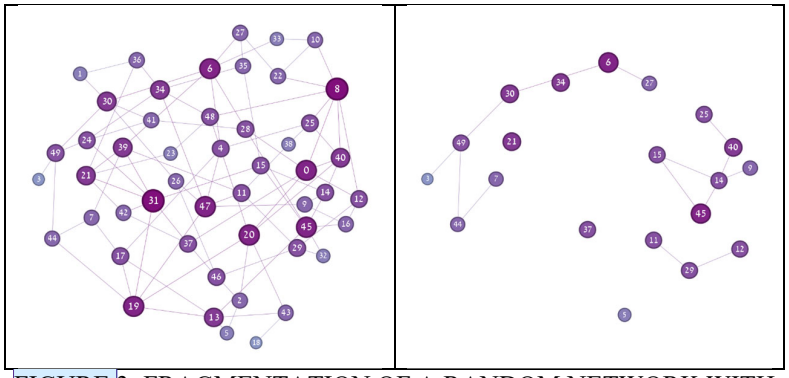

FIGURE 3: FRAGMENTATION OF A RANDOM NETWORK WITH RANDOM NODE REMOVAL

Commented [JN3]: Flagging that the numbers are too small to read in print. (There may be no way to fix that, but wanted to flag it.)

Commented [JR4R3]: Nick will try to fix.

In contrast, scale-free networks demonstrate remarkable resilience to *random* node removal, typically retaining connectivity until almost all nodes are removed.[44] This robustness stems from their hub-based topology: since hubs are numerically rare, random removal typically affects low-degree nodes, whose loss minimally impacts connectivity.[45] Figure 4 demonstrates this resilience, showing (right-hand panel) that network connectivity is retained despite substantial node removal.

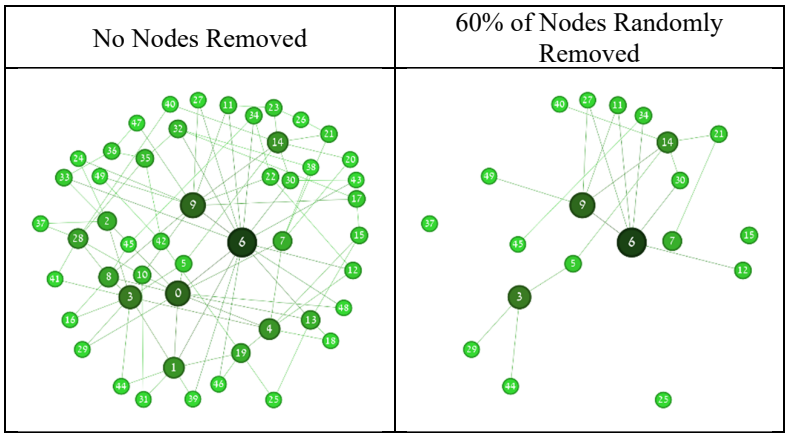

FIGURE 4: FRAGMENTATION OF A SCALE-FREE NETWORK WITH RANDOM NODE REMOVAL

At the same time, scale-free networks exhibit high vulnerability to hub removal due to their structural dependence on these high-degree nodes.

[44] *Id.* at 280–81.
[45] *Id.*

Although removing a single hub rarely fragments the network, the elimination of just 5–15% *of hubs* can catastrophically disrupt network connectivity.[46] Figure 5 (right-hand panel) demonstrates this vulnerability, showing network fragmentation into multiple small clusters and isolated nodes following hub removal.

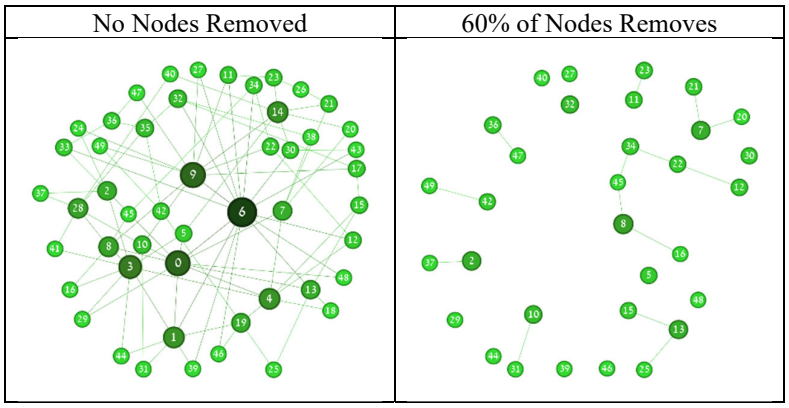

FIGURE 5: FRAGMENTING A SCALE-FREE NETWORK WITH HUB REMOVAL

Platform dependence is also influenced by a hubs' centrality within the network topology. Centrality is measured using metrics such as a node's average distance to all other nodes, or how often a node lies on the shortest path between any pair of nodes.[47] Consider Figure 6. Removing either of the hubs from this network would fragment half the network's low-degree nodes. Yet a node can be central without having many connections. In our figure, removing the central, albeit low-degree, node would be similarly destructive to network integrity due to its strategic positioning. This establishes an important insight: even platforms with extensive network effects can be broken by removing a limited number of key nodes.

---

[46] *Id*. at 285; Albert-László Barabási & Eric Bonabeau, *Scale Free Networks*, 288 SCI. AM. 50, 55–56 (2003).

[47] These metrics are referred to respectively as "closeness centrality" and "betweenness centrality." Alex Derr, *Network Centrality: Understanding Degree, Closeness and Betweenness Centrality*, VISIBLENETWORKLABS (Apr. 16, 2021), https://visiblenetworklabs.com/2021/04/16/understanding-network-centrality/.

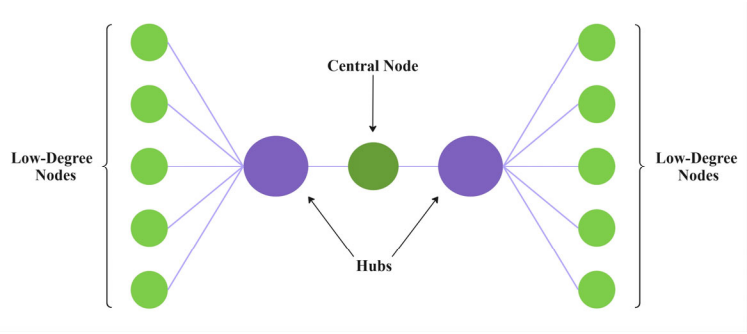

FIGURE 6: THE ROLE OF CENTRALITY

Platform dependence on a given hub is further influenced by a phenomenon known as a *cascade*, where the removal of one node induces other nodes to leave, creating a chain reaction.[48] For instance, each time a user leaves X for Bluesky, that user's friends may follow suit, triggering a further exodus of the friends' friends. This cascade effect, which is influenced inter alia by the network's topology, the idiosyncratic conditions for each node's departure, and the nature of the departure propagation process,[49] is amplified when highly connected hubs are removed.[50] As a result, the actual threshold for breaking scale-free networks in targeted attacks may fall well below the removal of 5–15% of hubs.

Finally, platform dependence is also influenced by *hub substitutability*, itself a function of the availability of comparable hubs and the platform's ability to attract or cultivate new ones. Replacing a departing hub is easier when hub attractiveness stems from subjective factors that can be replicated or promoted. For example, while Magnus Carlsen's chess skills make him irreplaceable on Chess.com, platforms in industries like music can potentially replace some stars by promoting lesser-known talents through targeted advertising, popularity metrics, and algorithmic content recommendations. These strategies leverage social influence to shape preferences and establish new hubs, thereby reducing the impact of a hub's departure.

---

[48] The Supreme Court recognized this in *Ohio v. American Express*, suggesting that if dominant networks abuse their power, they risk triggering a cycle of "negative feedback effects," causing an increasing number of participants to leave and jeopardizing the platform's overall integrity. *Ohio v. Am. Express Co.*, 138 S. Ct. 2274, 2281 n.1 & 2285 (2018).

[49] BARABÁSI, *supra* note 16, at 292; *see also* Agranat, *supra* note 19, at 239 and accompanying footnotes.

[50] BARABÁSI, *supra* note 16, at 292. Of course, not every hub departure leads to a platform's collapse. For example, when Trump was banned from Facebook, Instagram, and Twitter in 2021, these platforms withstood his exit. *Id.* at 257–58.

3. *The Hub's Switching Feasibility*

Hub power is also affected by the hub's dependence on the platform, which we refer to *switching feasibility.* This factor encompasses switching costs, which measure how readily a hub can multi-home or migrate to competitors. It also captures the hub's ability to reduce or cease operations on platforms altogether. To illustrate, in contrast to social influencers whose visibility and income rely heavily on continuous platform activity, Cristiano Ronaldo is far less dependent on his social media participation than on his craft for monetary gain. Assessing switching feasibility is crucial for evaluating the *countervailing power of the platform*, which in turn shapes the extent of hub power.

A hub's ability to migrate or multi-home depends on the availability and suitability of alternative platforms to support the hub's operations. This, in turn, is influenced by the technical complexities and costs associated with the transfer, which may vary by industry. For example, a YouTube streamer can seamlessly switch by opening a free account on Twitch, while a video game developer may face significant costs in time and resources when porting games between consoles, due to different technical requirements.

Switching feasibility is also influenced by the hub's ability to retain or recreate its following on the new platform. Retention depends on the "stickiness" of the original platform, including switching costs for its participants, their loyalty to the hub, and the hub's expected future appeal after integrating into the new platform. Stickiness is typically lower in industries where the hub's audience already uses the alternative platform. Recreation of a hub on the alternative platform by acquiring new connections largely depends on hub attractiveness, discussed above. Both retention and recreation enhance hub power, as they facilitate the hub's transfer and contribute to the growth of the rival platform. However, retention grants the hub greater power, as it also causes the original platform to lose existing nodes.

Network science offers sophisticated analytical tools to rigorously evaluate the key determinants of switching feasibility. For example, it sheds light on the stickiness of a hub and its connections by mathematically quantifying the network's *degree correlations.*[51] These correlations capture the tendency of nodes to connect with other nodes of similar and dissimilar degree. When hubs preferentially connect with other hubs and low-degree nodes connect with other low-degree nodes, the network exhibits an *assortative* topology, whereas when hubs and low-degree nodes preferentially connect with one another, the network exhibits a *disassortative* topology.[52] This computational

---

[51] BARABÁSI, *supra* note 16, at 236–38.
[52] *Id.*

analysis may prove indispensable because hubs are likely to exhibit a greater propensity to migrate from disassortative platforms than from assortative ones, as the former configuration minimizes interdependence among hubs. Furthermore, when imbued with big data analytics, network science enables precise modeling of node-idiosyncratic breaking thresholds—those critical junctures at which departure becomes rational—thereby facilitating predictive assessment of both hub and low-degree node exodus conditions, as well as any subsequent cascading effects on their network connections.[53]

Another key determinant of switching feasibility that network science can illuminate is *communities*: clusters of nodes that exhibit tight intragroup connectivity within network topologies.[54] To illustrate, consider a music-streaming platform wherein users differ according to their genre preferences, with some predominantly engaging with funk artists while others follow rock artists. A hub with strong connections within a specific community will exert greater influence within that group, and its departure is more likely to trigger a cascading effect confined to that community. For instance, while the progressive rock band Dream Theater commands a large and devoted fan base, its departure from Spotify would likely have minimal impact on users who do not listen to progressive rock. Resultantly, a platform's dependence on a specific artistic entity is modulated by community-specific dynamics. Should Dream Theater demand that Spotify not engage with an artist whose influence transcends community boundaries—exemplified by Taylor Swift, whose appeal spans multiple music segments—the latter's countervailing power would likely prove decisive in determining the platform's response, demonstrating the critical interplay between community structures and hub power. A similar outcome would most likely result when the two communities significantly differ in size. However, this conclusion greatly depends on the level of separation between the communities. The more detached the communities, the more localized the adversarial singers' power becomes.

In reality, communities are rarely hermetically isolated entities. Rather, they exhibit varying extents of interconnectedness, meaning a hub's sphere of influence frequently transcends its primary community's boundaries. For instance, consider a streaming platform where streamers and viewers have formed a community centered around the game Minecraft. The removal of a major Minecraft streamer triggers a cascading failure affecting platform participants whose engagement patterns extend beyond exclusive participation in the Minecraft community. It follows that this streamer possesses hub power

---

[53] See *id.* at 292–97.

[54] More strictly, a community is a "locally dense connected subgraph," wherein each node in the community is reachable through other nodes of the same community. *Id.* at 322, 325–27.

that extends beyond the Minecraft community, and this power grows as the effects of the departure can propagate across the platform.

4. *Countervailing Power Interplays*

The fourth determinant of hub power that we suggest decisionmakers should analyze is *countervailing power interplays*—the resistance hubs face from players *other than the platform*, including rival hubs, low-degree nodes, and even external entities. Importantly, such resistance can arise from entities beyond the direct target of the hub's conduct, reflecting the intricate web of interdependencies within and beyond the platform's boundaries that ultimately shape hub power. This factor will play a substantial role in many of the hub(use) examples explored in Part III below, demonstrating its explanatory utility across diverse platform ecosystems.

To illustrate, consider the following scenario. Suppose that a prominent singer demands that a music-streaming platform remove the content of a similarly prominent fellow artist. The platform's decision will hinge on its relative dependence on each singer and the risk of setting a precedent for further demands. The participant whose departure will inflict greater damage is likely the one with higher connectivity, especially when the difference is significant. However, predicting the full impact requires accounting for the complexity of potential cascading failures, which in turn depends on additional factors such as the centrality of each singer within the platform's network and the breaking thresholds of its participants.

Interestingly, in some situations low-degree nodes can also exert countervailing power against hub demands. Continuing the previous example, suppose the platform capitulated to the removal demand. Such a decision could ignite moral outrage among listeners, leading to a backlash that pressures the platform to reverse course. Moreover, the low-degree listeners can directly oppose the demanding singer by unfollowing the singer. This collective action could financially harm the singer and, over time, strip the singer of hub status on the platform.

A crucial consequence of countervailing interplays is the fundamentally contextual nature of hub power, implying that a hub's power cannot be conceptualized as a uniform construct applicable across all scenarios. Rather, it exhibits significant variability contingent upon the target and other affected stakeholders of the conduct under regulatory scrutiny (e.g., whether the exercise of power targets other influential hubs or more vulnerable nodes). Our analysis thus leads to the conclusion that hub power is inherently target-dependent—a nuanced perspective that challenges conventional monolithic approaches to evaluating market power.

C. SYNERGETIC METHODOLOGY FOR HUB POWER ASSESSMENT

Let us now streamline the four determinants just discussed into a cohesive and structured analytical framework that could enable decisionmakers to thoroughly evaluate hub power.

1. *Framework*

The analysis begins at the granular level, examining the fundamental attributes of individual nodes within a platform ecosystem. This node-level analysis centers on two key metrics: the node's current connectivity (measured by its degree) and its capacity to forge new connections over time. The assessment of hub attractiveness considers a node's inherent fitness—its natural ability to draw connections—alongside the dynamics of preferential attachment, whereby existing links facilitate securing new ones. By benchmarking these parameters against other nodes within the platform, regulators can establish meaningful thresholds for gauging hub power.[55] Notably, if a node's size or growth trajectory does not substantially exceed those of other nodes on the platform, we can reasonably conclude that it lacks hub power.[56] Otherwise, the node can be classified as a hub, though we must proceed to the next steps to determine the magnitude of its hub power.

Next, the analysis examines platform dependence—the strategic importance of these nodes to the platform's network integrity—by assessing potential network damage from hub departure or reduced activity. This evaluation considers the hub's significance to network integrity based on the platform's topology. The assessment begins by classifying the network topology—such as random or scale-free—as each structure impacts resilience differently. Equally crucial is the evaluation of degree correlations. Assortative networks, where hubs predominantly connect to other hubs, generally exhibit

---

[55] To illustrate, the Bianconi–Albert model provides a simple model of how fitness and preferential attachment can jointly shape network evolution. *See* BARABÁSI, *supra* note 16, at 204–06. While this proof-of-concept model provides intriguing insights, it does not capture several real-world commercial conditions, such as the potential for fitness to change over time or the fact that preferential attachment dynamics can, under certain circumstances, overpower fitness dynamics. Nevertheless, with sufficient data, it is possible to model the interplay between preferential attachment, fitness, and other mechanisms in real-world networks. By tracking the rate at which nodes of different degrees acquire new links over time, a network scientist can infer the roles these mechanisms play in shaping the network's evolution. We thank Prof. Barzel for this clarification.

[56] Hub power fundamentally stems from a hub's degree being orders of magnitude higher than that of the average node, implying that a low-degree node lacks hub power. The magnitude of hub power is, of course, always relative.

greater resilience to individual hub departures due to built-in redundancy.[57] The analysis further examines community structures within the platform, assessing whether potential damage from a hub's departure would remain localized within specific communities or propagate across the entire network.

Beyond topology, a key consideration that shapes platform dependence is hub-substitutability—whether the hub is unique or replaceable through existing substitutes or potential ones that could emerge to fill its role. After all, a platform's ability to replace a departing hub without disruption grants it substantial negotiating leverage. Finally, the investigation must account for potential cascading failures by analyzing breaking thresholds across platform participants. This analysis reveals how an initial hub departure might trigger subsequent exits and broader instability. These factors collectively illuminate the platform's underlying hub dependence and its susceptibility to strategic behavior.

Finally, the analysis evaluates market dynamics beyond the platform's boundaries, focusing on two dimensions. First is the hub's dependence on the platform, measured by the hub's ability to exit the platform—whether by switching platforms, maintaining a multi-platform presence, or abandoning platforms altogether. High mobility across platforms or ability to operate independently can significantly enhance a hub's leverage, while strong dependence on the platform may constrain its power despite other advantages.

The mobility analysis begins with a systematic evaluation of viable alternative platforms, assessing their overall suitability in supporting the hub's needs. Once suitable alternatives are identified, the investigation assesses switching feasibility, accounting for technical requirements, infrastructure modifications, and data transfer costs. Critical to this assessment is understanding the hub's ability to maintain its degree post-migration, whether through transferring existing connections or establishing new ones. The analysis must also consider the hub's interdependencies with other hubs on the platform, as these relationships can significantly impact switching complexity. This dependence can be quantified by examining the platform's network assortativity. High assortativity suggests stronger hub interdependence, potentially complicating platform switches and affecting the hub's true bargaining power.

The second dimension examines the countervailing power that other platform participants can exert. The analysis should begin by identifying the hub's target – whether a low-degree node, another hub, or the platform itself – as each scenario involves distinct power dynamics. The actual influence of hubs targeting other platform participants depends on the target's capacity to

---

[57] *Id.* at 236–37, 257.

mount effective resistance. Central to this resistance is the target's ability to initiate its own network cascades, potentially positioning itself as a preferable alternative for the platform. The platform may strategically support the target to avoid more severe network disruptions, thus significantly constraining the original hub's power. This interplay of cascade threats and platform incentives creates a complex dynamic where the mere potential for effective resistance can curtail hub power. Additionally, the analysis needs to evaluate the platform's market power vis-à-vis competing platforms. A platform with a precarious market position compared to its competitors may be more hesitant to resist hub(uses), as doing so could further destabilize its network and jeopardize its competitive standing.

2. *Application*

Let us now apply this synthesized methodology to show why chess grand master Carlsen, introduced in the opening paragraph of this article, has all the markings of hub power. At a granular level, Carlsen exhibits unparalleled hub attractiveness, stemming from both his exceptional fitness (i.e., chess prowess) and immense popularity among viewers and players alike—bolstered by an extensive list of accolades, including five World Championship titles and the longest unbroken reign as the world's top-ranked chess player in history—creating strong preferential attachment.[58]

Widening our lens to Chess.com, its platform dependence on Carlsen appears to be exceptionally high. Even though Chess.com is the world's largest chess platform, the loss of Carlsen would likely have triggered a substantial decline in user engagement. For instance, his departure would have diminished the appeal of Chess.com's organized tournaments not only for viewers but also for other players eager to compete against him. Importantly, given that Carlsen—and similarly ranked players—frequently compete against lower-ranked opponents, his exit would risk a cascading disengagement effect, propagating well beyond the top tiers of the ranking hierarchy. Moreover, while nearly all top-ranked players are active on Chess.com, the platform maintains formal commercial relationships with only a select few. Notably, Chess.com installed Carlsen as a brand ambassador after acquiring his rival platform, Play Magnus, explicitly leveraging his prominence to drive engagement across the site.[59] Finally, due to Carlsen's unique combination of

---

[58] *Neimann v. Carlsen*, No. 4:22-cv-01110-AGF, 2023 WL 4198227, at *1 (E.D. Mo. June 27, 2023).

[59] *Chess.com Officially Acquires Play Magnus, Carlsen Signs as Ambassador*, CHESS.COM (Dec 21, 2022), https://www.chess.com/news/view/chesscom-acquires-pmg#:~:text=In%20addition%20to%20the%202023,questions%20from%20the%20chess%20community.

prowess and popularity, his hub-substitutability for Chess.com is exceptionally low, further magnifying the platform's reliance on him.

While Chess.com's dependence on Carlsen is substantial, Carlsen's own switching feasibility is relatively high. During the relevant timeframe, Carlsen operated across multiple chess streaming platforms. He faces no technical barriers to changing platforms and, with an estimated net worth of approximately $ 25 million,[60] he is financially secure enough to retire altogether if he so chose. Notably, although Chess.com acquired Play Magnus—the rival platform Carlsen founded—he reportedly holds no equity stake in Chess.com, [61]which further reduces any structural or financial lock-in. Should Carlsen decide to switch platforms, it is highly likely he would attract a substantial portion of his audience with him. Just as Carlsen can move freely, so too can viewers, who face minimal friction in following his games elsewhere, making any departure potentially disruptive for Chess.com.

Finally, no other platform participant both possessed the ability and had sufficient incentive to exert countervailing power. Niemann's following was significantly smaller than Carlsen's, while Nakamura— consistently ranked among the world's top ten chess players and a prominent chess streamer—quickly aligned with Carlsen.[62] Just like in other sporting events, for top players, playing in tournaments without the leading players reduces the challenge and the interest of viewers and—by extension—might reduce the financial compensation. In addition, both Carlsen and Nakamura had lucrative streaming contracts with Chess.com,[63] further solidifying their interest in ensuring it remains strong.

D. Implications for Simplistic Market Power Indicators

The above analysis of the intricate interplay between platforms, hubs, and nodes reveals a crucial insight: hub power is prone to elude traditional market power indicators in platform markets. In particular, relying on simplistic metrics—such as focusing on the *hub's number of connections* relative to the total number of connections across all competing platforms in a given market—may utterly fail to capture the true extent of hub power.

---

[60] *Magnus Carlsen Networth,* Celebrity Net Worth, https://www.celebritynetworth.com/richest-celebrities/authors/magnus-carlsen-net-worth/ (noting that the majority of Carlsen's net worth is attributable to Play Magnus—which Chess.com acquired—and whose valuation in recent years has been estimated at approximately $10–20 million)

[61] Cite.

[62] *Id*. at 9.

[63] *Id.* at 18.

Assume, for instance, a setting in which several music-streaming platforms compete in a market for a specific music genre. Counting only the number of connections each artist has to listeners does not fully capture the artist's power as a hub. First, such an approach fails to account for the weight of each connection (i.e., the number of times each listener played the artist's songs within a given timeframe), which would be tantamount to measuring market share in a traditional industry by counting trading partners rather than transactions. Moreover, the platform's networked setting compounds the problem well beyond this shortcoming. As discussed, determining a hub's true power requires considering additional critical factors—particularly potential cascades should the hub exit the platform and the presence of countervailing power—which introduce complexities generally absent in traditional market structures. Accordingly, as our detailed examples in the following Part demonstrate, a hub can effectively leverage platform dynamics to exercise monopolistic influence even though its number of connections—albeit large in comparison to other nodes—is not large relative to the total connections on the platform(s), well below the high threshold typically associated with market dominance.[64]

This disconnect between traditional metrics and actual power highlights the need for more sophisticated analytical approaches when evaluating platform competition. It necessitates a paradigmatic reconfiguration of market power conceptualization that accounts for both intra- and inter-platform dynamics, in line with the four determinants identified above.

E. The Effects of Hub Power on Platform Power

As we elaborate elsewhere, our framework for assessing hub power carries important implications for evaluating platform power.[65] Here we outline the core elements of this relationship.

Most straightforwardly, the presence of hub power can counteract, discipline, or redirect platform power. Powerful hubs can resist platform dictates or compel particular platform conduct, affecting the platform–hub relationship. Less obviously, hubs' ability to migrate across platforms can expose platforms to "hub-plucking" competition, weakening their power not only vis-à-vis hubs but also vis-à-vis other participants and rival platforms. This

---

[64] Courts typically require a high market share to find monopoly. *See, e.g., Am. Tobacco Co. v. United States,* 328 U.S. 781, 797–98 (1946); *United States v. Grinnell Corp*., 384 U.S. 563, 571 (1966); *see also* U.S. Dep't of Justice, Competition and Monopoly: Single Firm Conduct Under Section 2 of the Sherman Act ch. 2 (May 11, 2009), https://www.justice.gov/archives/atr/competition-and-monopoly-single-firm-conduct-under-section-2-sherman-act-chapter-2.

[65] Agranat & Gal, *supra* note 17.

dynamic renders the market position of platforms more precarious, calling into question conventional assumptions about the strength and durability of their market power and the potential for its abuse.[66] While "plucking" of a powerful supplier/ manufacturer/distributor can affect market power in non-platform markets, such a strategy usually does not create such an immediate loss of market power as when cascading occurs—especially when it is strengthened by network effects.

A further insight derived from our analysis is that platform power—like hub power—is inherently nonuniform.[67] It depends on the unique and evolving network dynamics of both the platform and its rivals. A platform's power over any given participant largely depends on that participant's ability to migrate to a rival platform—in other words, on how substitutable the platform is to that participant. Yet assessing the substitutability of platforms is fundamentally different from evaluating the substitutability of other products in conventional markets. A platform's value to its participants is generated through network interactions, which are constantly evolving[68]. Moreover, each participant is situated differently within the networks of the platform on which it operates—a difference that is especially pronounced for hubs, given their central and influential positions.[69]

This insight can be illustrated by examining the ability of different hubs to resist platform pressure. This ability depends on the four determinants that govern hub power suggested above. Consider switching feasibility. Hubs may face vastly different switching costs due to variations in their network connectivity—that is, their position within the platform's network architecture, particularly the number and strength of their connections to other nodes within the platform—reflecting the inherent dynamism of a platform's network.[70] Multiple connectivity layers may be relevant. To illustrate, consider two hubs with a similar number of links (e.g., followers). Convincing a hub with a high degree of connectivity to switch platforms can be much more difficult than convincing one with a low degree, due to the reduced incentives such connectivity creates for the former's nodes to migrate with it. Hence, evaluating platform substitutability for particular hubs differs markedly from evaluating the interchangeability of homogeneous inputs (e.g., shoe soles) across buyers that require similar inputs. While different shoemakers may not perceive the substitutability of *the product* offered by various sole suppliers

---

[66] *Id.*
[67] *Id.*
[68] Cite.
[69] Cite.
[70] Variations in hubs' network connectivity arise from the probabilistic nature of the preferential attachment mechanism that governs network growth. BARABÁSI, *supra* note 16, at 167–69.

differently, such divergence is entirely plausible in the realm of hubs and hosting platforms. Accordingly, when assessing the competitive pressure a platform must withstand—whether arising internally or from the potential for hub-plucking— we cannot rely on market-wide abstractions of switching costs. Instead, the analysis must account for each hub's network position and its idiosyncratic substitutability. Fortunately, network science supplies tools that make this feasible with manageable effort and, as we discuss elsewhere, enforcers can develop generalized assumptions that would simplify the analysis.[71]

The next Part further demonstrates how entities can leverage complex platform dynamics to exert disproportionate influence relative to their perceived market standing, engendering outcomes not readily explained by conventional metrics of market power.

II. THREE MANIFESTATIONS OF HUB POWER

Hub power lends itself to strategic deployment that can either enhance social welfare by fostering vibrant inter-platform competition through hub-plucking or enabling resistance to platform abuses, or diminish it through what we term a hub(use). These exercises of power can target various entities: platforms, competing hubs, low-degree nodes, or third parties. This Part analyzes different manifestations of hub(uses).

Notably, hub power need not emanate from a single hub but can emerge from the combined leverage of multiple nodes. Accordingly, we structure this Part around three distinct scenarios, each differing in how hub power is sourced and channeled through the network. The first two pertain to the traditional categories of unilateral and concerted exercises of hub power. The third is less conventional and involves unilateral conduct that harnesses the combined power of unwitting network participants. Within each category, we identify case studies that relate to different targets (denoted as hub vs. [target]). While our analysis does not presume that exercises of hub power are necessarily welfare-reducing, it demonstrates the potential for such adverse effects. We also demonstrate how network science empowers the analysis by offering nuanced methodologies that reveal welfare effects with greater precision than conventional ones. As such, our analysis challenges some of the assumptions ingrained in our competition laws regarding both harms and benefits of a given conduct, as well as the efficacy of different remedies. It also

[71] *See* Agranat & Gal, *supra* note 13.

blurs the rigid distinction between unilateral and coordinated conduct that undergirds competition laws.[72] We conclude with an integrative table.

A. UNILATERAL CONDUCT

Some hubs possess sufficient hub power to unilaterally exercise hub power towards others. We offer both overt and covert examples.

1. *Overt Exercises of Hub Power*

Exercises of hub power can be direct. A paradigmatic example is a retail hub demanding better pricing terms from an e-commerce platform (hub vs. platform).

Less trivially, exercises of hub power can operate through indirect mechanisms, whereby the hub induces actions by other network participants against particular targets. For example, a hub might trigger conduct by *low-degree nodes* against a rival hub (hub vs. hub via nodes). The case of James Charles, an influential American YouTuber who offers beauty advice[73] with approximately 16 million subscribers on YouTube and a comparable following on Instagram, exemplifies this dynamic. Charles set off a storm with an Instagram post in which he promoted a specific brand of nutritional hair supplements.[74] His actions sparked outrage from Tati Westbrook, a fellow YouTube beauty influencer and former collaborator with about 5 million subscribers,[75] who sold a competing brand of supplements through her company. Within hours, Westbrook uploaded a series of videos to Instagram, accusing Charles of inappropriate behavior, including unwanted sexual advances toward other individuals.[76] The backlash was swift and severe: Charles lost over 2 million YouTube subscribers.[77] Prominent celebrities, including Miley Cyrus, Shawn Mendes, and Kylie Jenner, unfollowed him on Instagram, amplifying the public condemnation and the cascading effect.[78] Westbrook benefited significantly from the feud, gaining over 1.5 million new

---

[72] Including, at the most fundamental level, antitrust laws. *See e.g.*, Sherman Act, 15 U.S.C. §§ 1–2.

[73] Valeriya Safronova, *James Charles, From 'CoverBoy' to Canceled*, N.Y. TIMES, (May 14, 2019), https://www.nytimes.com/2019/05/14/style/james-charles-makeup-artist-youtube.html; Just Lunning, *YouTuber James Charles Loses 2 Million Subscribers Following Tati Westbrook Feud*, NEWSWEEK (May 11, 2019), https://www.newsweek.com/youtuber-james-charles-subscribers-drops-million-following-feud-1423039.

[74] *See* sources noted, *supra,* at note 68.

[75] *Id*.

[76] *Id*.

[77] *Id*.

[78] *Id*.

subscribers.[79] This case thus demonstrates how a hub can unilaterally leverage its power on the platform to indirectly undermine the following of another hub. It also shows that the content of the transmission might be more important than the relative size of the hubs, and that hubs can harness the public opinion shaped by external third parties to amplify a cascading effect on another hub.

Hubs can also indirectly leverage their power by pressuring *the platform* to take action for their benefit (hub vs. hub/node via platform), with the platform's decision to act or abstain often depending on the relative power of the hub compared to the target. The Spotify–Rogan controversy presents an illuminating case study in network dynamics and countervailing power within digital platforms. The conflict surrounded "The Joe Rogan Experience," a globally popular podcast hosted by the unorthodox comedian and presenter Joe Rogan.[80] Following controversial remarks made by Rogan and his guest Robert Mellon regarding the U.S. response to Covid-19, remarks that leading scientists claimed were falsehoods,[81] the musician Neil Young threatened to pull his works from Spotify unless the platform removed Rogan.[82] When Spotify declined to do so, Young withdrew his music, a move that inspired other prominent artists to do the same but did not alter Spotify's stance.[83] Interestingly, other nodes—whether content providers or subscribers who prioritize content diversity and freedom of expression—may have constituted a significant counterweight to Young's act, despite having no direct stakes in this feud. This dynamic also illustrates how platform governance can be shaped by dispersed nodes whose aggregate preferences carry substantial weight in platform decision-making. A diametrically opposed platform response manifested in the case delineated in the introductory Part of this article wherein chess grandmaster Magnus Carlsen declared that he would no longer

---

[79] *Id*.

[80] Todd Spangler, *Joe Rogan Had the Most Popular Podcast on Spotify in 2022*, VARIETY (Nov. 30, 2022), https://variety.com/2022/digital/news/joe-rogan-spotify-top-podcast-2022-1235444743/.

[81] Ben Sisario, *Spotify Is Removing Neil Young Songs After He Complains of 'Misinformation'*, N.Y. TIMES (Jan. 26, 2022), https://www.nytimes.com/2022/01/26/arts/music/spotify-neil-young-joe-rogan.html.

[82] *Id*.; Sian Cain, *Neil Young Demands Spotify Remove His Music Over Joe Rogan Vaccine Misinformation*, GUARDIAN (Jan. 25, 2022), https://www.theguardian.com/music/2022/jan/25/neil-young-demands-spotify-remove-his-music-over-joe-rogan-vaccine-misinformation.

[83] Maya Yang & Ben Beaumont-Thomas, *Spotify Removes Neil Young Music in Feud Over Joe Rogan's False Covid Claims*, GUARDIAN (Jan. 27, 2022), https://www.theguardian.com/technology/2022/jan/26/spotify-neil-young-joe-rogan-covid-misinformation; Mary Biekert, *Here's a List of Artists Who are Boycotting Spotify Because of Joe Rogan,* TIME (Feb. 2, 2022), https://time.com/6144634/artists-boycott-spotify-joe-rogan/.

participate in events involving Hans Niemann. Despite the evidence against Niemann being largely circumstantial, Chess.com strategically aligned with Carlsen—a decision potentially attributable to the substantial asymmetry in hub power between the two grandmasters.[84]

These unilateral hub vs. hub scenarios, whether involving direct harm to other hubs or pressuring the platform, its participants, and even third parties to act indirectly on the hub's behalf, are relatively straightforward to grasp. The anticompetitive nature of this conduct is evident: hub power is exercised to suppress rival hubs without yielding offsetting efficiency gains. Such conduct may harm not only competitors, but also competition, when it results in significant reduction of options to consumers. It also lowers the value derived from the network for other participants, including consumers. Yet, as the ensuing discussion illustrates, such scenarios have thus far largely evaded scrutiny because the concept of hub power has been largely opaque to antitrust law. Once its presence is acknowledged, the challenge shifts to accurately assessing its true magnitude and effects, which are crucial for determining the potential for anticompetitive harm.

Of course, not all unilateral exercises of hub power are anticompetitive. Hub power can also be used to counteract anticompetitive behavior by platforms. To illustrate, consider *Davitashvili et al. v. Grubhub*.[85] The plaintiffs sued the food delivery platforms Grubhub, Uber Eats, and Postmates for preventing restaurants selling on their platforms from offering lower prices directly to consumers or through competing platforms like DoorDash.[86] The plaintiffs argued that these restrictions caused them to pay artificially higher prices for restaurant meals when dining in, as they were effectively forced to subsidize the costs of delivery.[87] If any hubs on the platforms exercised their power to resist such demands, their actions would serve as a check on anticompetitive conduct.

---

[84] Carlsen participated in several online games against Niemann in 2024 but avoided playing him in person (one match featuring the two was held in person, but games were played on a computer). Carlsen explained that he had no "out" to avoid this match. Colin McGourty, *Carlsen Leads WR Chess to World Blitz Team Championship Gold*, CHESS.COM (Aug 6, 2024), https://www.chess.com/news/view/2024-fide-world-rapid-blitz-team-chess-championships-day-4; GothamChess, *The Magnus Carlsen Interview*, YOUTUBE, at 19:20 (Sep 6, 2024), https://youtu.be/vdpn_WV0YwE?t=1160.

[85] Complaint, *Davitashvili v. Grubhub Inc.*, No. 1:20-cv-03000 (S.D.N.Y. Apr. 13, 2020).

[86] *Id.* at *1.

[87] *Id.*

2. *Legal limitations: The Case Against Carlsen and Chess.com*

Even relatively straightforward instances of hub(use) remain an uneasy fit for existing antitrust prohibitions regulating unilateral conduct.[88] This tension is illustrated in Hans Niemann's failed attempt to sue Magnus Carlsen and Chess.com for anticompetitive conduct.[89] Niemann alleged that Carlsen and Chess.com engaged in a concerted refusal to deal, producing ripple effects across the chess community.[90] He further claimed that Chess.com's acquisition of Play Magnus—a chess platform founded by Carlsen that the court described as the "second most dominant commercial enterprise in chess"[91]—amounted to an attempted monopolization of the so-called "Competitive Chess Market," which Niemann defined to include both professional chess tournaments and online recreational chess platforms.[92] This, he argued, left him with no meaningful alternative for engaging in competitive chess,[93] giving Chess.com effective control over which chess players participate in the relevant market.[94] The court's ultimate dismissal of these claims laid bare glaring weaknesses in antitrust doctrine's approach to hub power abuses.[95]

As elaborated above, Carlsen holds significant hub power over Chess.com,[96] and his actions were an overt exercise of that power.[97] He could

---

[88] 15 U.S.C. § 2; *United States v. Grinnell Corp*., 384 U.S. 563, 570–71 (1966); Fed. Trade Comm'n Act, 15 U.S.C. § 45; FED. TRADE COMM'N, POLICY STATEMENT REGARDING THE SCOPE OF UNFAIR METHODS OF COMPETITION UNDER SECTION 5 OF THE FEDERAL TRADE COMMISSION ACT, Commission File No. P221202, at 8–10 (Nov. 10, 2022), https://www.ftc.gov/system/files/ftc_gov/pdf/P221202Section5PolicyStatement.pdf.

[89] *Neimann v. Carlsen*, No. 4:22-cv-01110-AGF, 2023 WL 4198227, at *__ (E.D. Mo. June 27, 2023).. The suit was brought against other defendants as well, which we disregard for the purpose of this analysis.

[90] 15 U.S.C. at § 1, et seq.

[91] *Neimann*, 2023 WL 4198227, at *6.

[92] *Id.* at *2 & n.1.

[93] *Id.* at *7.

[94] *Id*. at 22.

[95] *Id*. at 1. Other charges included, inter alia, libel, slander and tort.

[96] See Part II *supra*.

[97] For the purposes of this article, we disregard the question of potential non-economic motivations that might have triggered Carlsen's strong response, rather than a strategy to exclude a rival and increase his monopoly profits. Instead, we assume that the allegations were not sufficiently substantiated. Notably, on August 28, 2023, Niemann, Carlsen, and Chess.com announced that they had reached an agreement over the matter, in which Niemann was fully reinstated on Chess.com and permitted to participate in future Chess.com events. Carlsen also held hub power over Niemann. Furthermore, even if Niemann cheated, and his conduct harmed the integrity of the

have easily foreseen that his refusal to play Niemann in any tournament or event would significantly impair Niemann's ability to compete. Indeed, Chess.com immediately banned Niemann from its platform and sponsored events,[98] other top players refused to play him,[99] and organizers of professional chess tournaments soon followed suit.[100] Given Carlsen's stature in the chess world and his participation in events hosted by various tournament organizers, Chess.com was disincentivized from unilaterally resisting Carlsen. Doing so would have placed it at a competitive disadvantage relative to organizers who complied with his demands and could therefore feature him in their tournaments.[101] Indeed, preventing the ban might have necessitated a concerted effort by multiple major tournament organizers to resist Carlsen's implicit demands. Consequently, Carlsen's actions effectively removed a top chess player from the competitive chess scene.

These intra-platform dynamics did not factor into the court's analysis. Instead, it focused exclusively on inter-platform and inter-tournament competition as the sole forms of competition it deemed legally relevant.[102] This narrow focus led the court to conclude that Niemann did not suffer an "antitrust injury," thereby stopping his antitrust claims in their tracks. Specifically, the court held that Niemann's alleged injuries bore no nexus to any harm to competition, since he "operated neither a professional chess tournament nor an online recreational chess platform," and therefore did not compete in the relevant market.[103]

The court's analysis suffers from two major flaws: its treatment of the downstream market (organization of chess tournaments) and its disregard of the upstream market (provision of top-level chess players). By disregarding intra-platform dynamics in the downstream market, the court failed to address the substantial competitive harms resulting from Carlsen's exercise of hub power. It is doubtful whether the court's exclusive focus on inter-platform

---

sport, and the organizers of chess tournaments' reactions were insufficient in that regard, *Fashion Originators* suggests that the wielding of economic power to achieve what might be a welfare-enhancing result is not permitted when those means violate fundamental antitrust principles. *Fashion Originators' Guild of Am. v. FTC*, 312 U.S. 457, 467–68 (1941).

[98] *Neimann*, 2023 WL 4198227, at *13.

[99] *Id.* at *16.

[100] *Id.*

[101] *Id.* at *13.

[102] This narrow focus might have at least partially resulted from Niemann's definition of the market, elaborated in this Part, *supra*.

[103] *Id.* at *23.

competition corresponded to existing antitrust law,[104] and the court offered no justification for this position.[105] Moreover, from a normative perspective, attempting to address intra-platform harms resulting from the exercise of hub power by focusing exclusively on harms to inter-platform competition is, at best, a tenuous policy.

Yet even if the court had embraced a more expansive view of antitrust's application to platform dynamics, it still would have confronted the inherent limitations of current antitrust doctrine—both the prohibition against agreements in restraint of trade and the prohibition against monopolization—in capturing the effects of unilateral hub(uses), thereby allowing certain unilateral exercises of hub power to escape antitrust scrutiny.

The biggest impediment to allegations of concerted action is the requirement to prove an *agreement* in restraint of trade.[106] This is because Chess.com's action seems to be an independent decision prompted by Carlsen's unilateral refusal to participate in any tournament featuring Niemann—a reaction that cascaded to other prominent players and tournament organizers. Indeed, Chess.com had no endogenous interest in banning Niemann without substantiated proof of cheating; on the contrary, doing so meant losing access to an exceptionally gifted and marketable chess talent. This act against self-interest[107] is only explained by Carlsen's exercise of hub power. Indeed,

---

[104] The foundational case which acknowledges the importance of intra-firm for inter-firm competition is *Continental T.V., Inc. v. GTE Sylvania, Inc*., 433 U.S. 36 (1977).

[105] *Neimann*, 2023 WL 4198227, , at *23–25.

[106] 15 U.S.C. § 1 ;Clayton Act**,** 15 U.S.C. § 14. The difficulties in proving an agreement in cases involving allegations of termination of a course of dealing at the request of (a) powerful rival(s) can also be demonstrated by the Supreme Court's decision in *Monsanto v. Spray-Rite Serv. Corp.*, 465 U.S. 752 (1984).

[107] Coercion offers a narrow avenue of defense for firms compelled to participate in anticompetitive conduct, as the legal thresholds for establishing it are very stringent. To invoke it successfully, a firm must present clear evidence that, inter alia, it had no realistic alternative but to comply with the anticompetitive conduct. Crucially, mere economic pressure, competitive disadvantages, or fear of losing business relationships all fall short of meeting the coercion threshold. *See, e.g., United States v. Paramount Pictures, Inc*., 334 U.S. 131, 161 (1948); *Ford Motor Co. v. U.S.*, 335 U.S. 303 (1948); Jean Wegman Burns, *The New Role of Coercion in Antitrust*, 60 FORDHAM L. REV. 379, 384 (1991). Coercion in vertical relationships must also be marked by significant power imbalances. *See, e.g.*, W. Perry Brandt, *Tying Arrangements and the Individual Coercion Doctrine*, 30 VAND. L. REV. 755 (1977); Chad Plumley, *Why Coercion Should be a Defense in Section 1 Cases Involving Vertical Agreements*, 48 MERCER L. REV. 1761 (1997). This state of affairs carries notable implications for cases involving unilateral hub(uses). First, judicial recognition of hub

when a platform acts in a manner that appears to harm its own network, it might signal potential hub(use).

Accordingly, unilateral conduct might offer a more appropriate analytical lens. The court focused on Chess.com's unilateral action, concluding that "the actions taken against Niemann . . . did not increase Chess.com's market power."[108] However, this focus is too narrow, as the monopolization prohibition also applies to the maintenance of market power. [109] Indeed, Chess.com did not align with Carlsen to increase its market power; it did so to prevent its erosion. Refusing to feature Carlsen would have allowed Chess.com's rivals to gain a significant advantage by aligning with him instead. Moreover, regardless of whether Chess.com's rivals had acceded to Carlsen's demand, Chess.com's refusal would have resulted in a significant decline in its appeal to viewers most interested in his play. Thus, it was Chess.com's comparative lack of power relative to Carlsen's hub power that drove its decision-making.

This underscores the uneasy doctrinal fit in using monopolization law against the platform to address unilateral abuses by powerful hubs that exert outsized influence over platform conduct.[110] This difficulty stems from the legal requirements that a single entity—in our case the platform—must possess market power *and* be the perpetrator of the abuse,[111] designed to maintain

---

power may strengthen a platform's coercion defense. More importantly, while antitrust law is barely willing to excuse a coerced firm from condemnation, it categorically refuses to excuse the party doing the coercing. Rendering hub power illegible to antitrust analysis would therefore create a jurisprudential inconsistency: the hub—the party exerting pressure and driving the anticompetitive conduct—would remain beyond the law's reach and escape antitrust liability.

[108] *Neimann*, 2023 WL 4198227, at *28. The court also concluded that Niemann's professional and reputational injuries are not the type that the antitrust laws were intended to prevent, as the injury is to Niemann alone. *Id* at 24. Yet the case law opens the door to antitrust claims if the individual harm is related to competition, having a significant effect on either the supply of or demand for the professional services or on the fees charged for such services. *See, e.g., Wagner v. Magellan Health Servs., Inc.*, 121 F. Supp. 2d 673, 681–82 (N.D. Ill. 2000); *Martin v. Am. Kennel Club, Inc.*, 697 F. Supp. 997, 999–1002 (N.D. Ill. 1988). Given that Niemann beat the world's greatest player, it can be argued that his removal from chess tournaments has implications for the supply of elite chess players that can compete at the highest level, the epicenter of exciting tournaments for viewers and participants alike. Accordingly, it was plausible to argue that the concerted actions impacted competition in the market for elite players.

[109] *See, e.g., United States v. Grinnell Corp*., 384 U.S. 563, 571 (1966).

[110] *Cf. also Monsanto*, 465 U.S. 752.

[111] *See, e.g., Eastman Kodak Co. v. Image Tech. Servs., Inc.*, 540 U.S. 451, 488 (1992). ("Our § 2 monopolization doctrines are similarly directed to discrete

or strengthen *its own* market power.[112] Monopolization generally involves erecting artificial entry barriers to exclude the monopolist's own rivals. Some courts have even required proof of exclusionary effects in the monopolist's market(s).[113] However, from a normative standpoint it should not matter whether a monopolistic platform erects artificial barriers on its own accord or acts in a similar way as a result of acceding to the demands of a powerful hub within its network; and again, when inter-platform competition is highly unlikely, whether the exclusionary effects of the conduct are limited to its own market.[114]

The case's narrow focus on the platform's conduct which disregards hub power dynamics, generates a paradoxical outcome: the greater a hub's influence, the less capable existing doctrine becomes at addressing the resulting anticompetitive harm. To illustrate, consider two contrasting scenarios concerning the economic conditions underlying Carlsen and Chess.com's ban of Niemann. In the first scenario, Chess.com holds monopoly power in the market for chess tournament organizers. In the second, Chess.com operates as one of ten comparably sized platforms, with Carlsen functioning as a hub on all of them. These scenarios differ markedly in Carlsen's switching feasibility and the resulting power asymmetry between Carlsen and Chess.com—while in the first scenario Chess.com possesses greater power and Carlsen is relatively weaker, in the second, the opposite is true.

These scenarios expose a misalignment with the notion that antitrust intervention is especially warranted where market-based solutions are inadequate. In the first scenario, Chess.com may have sufficient power to resist Carlsen (potentially rendering intervention unnecessary), yet antitrust law

---

situations in which a defendant's possession of substantial market power, *combined with his* exclusionary or anticompetitive behavior, threatens to defeat or forestall the corrective forces of competition and thereby sustain or extend the defendant's agglomeration of power." (emphasis added)).

[112] *United States v. Grinnell Corp*., 384 U.S. 563, 571 (1966).

[113] *See, e.g.*, *Intergraph Corp. v. Intel Corp.,* 195 F.3d 1346 (Fed. Cir. 1999); Robert Pitofsky, Donna Patterson & Jonathan Hooks, *The Essential Facilities Doctrine Under United States Antitrust Law*, 70 ANTITRUST L.J. 443, 461 (2002)(stating that numerous courts have emphasized that it is the plaintiff's status as a competitor of the alleged monopolist—not as its customer—that allows a firm to seek relief under the essential facilities doctrine).

[114] Courts have acknowledged that legal and economic effects do not necessarily overlap. *Cf., e.g.*, *Copperweld Corp. v. Independence Tube Corp*., 467 U.S. 752, 774 (1984)("Because the Sherman Act does not prohibit unreasonable restraints of trade as such—but only restraints effected by a contract, combination, or conspiracy—it leaves untouched a single firm's anticompetitive conduct (short of threatened monopolization) that may be indistinguishable in economic effect from the conduct of two firms subject to § 1 liability.").

could nonetheless engage: it might deem Carlsen's refusal to play Niemann an insufficient justification for Chess.com's refusal to deal with Niemann, thereby finding the latter's conduct abusive.[115] In stark contrast, in the second scenario—where all ten platforms face intense competitive pressure to accede to Carlsen's demands—the lack of market power on any one platform implies that Carlsen's conduct evades antitrust scrutiny entirely.

Judicial recognition of hub power might pave the way toward addressing this apparent enforcement gap. Hubs offering unique products may operate in distinct upstream or downstream markets that are vertically connected to the platform(s). Hubs' market share in these markets better captures their market power toward the platform and other participants than their number of connections on the platform. As Carlsen's participation is paramount for top-level chess streaming and tournament organization, he could be deemed to possess monopoly power in the labor market[116] for championship-caliber

---

[115]While the refusal-to-deal doctrine is most commonly applied where a monopolist refuses to deal with a competitor, there have been instances where a plaintiff successfully pleaded refusal to deal with a non-rival. For example, in *Lorain Journal Co. v. United States*, the only newspaper in town was found liable for refusing to sell advertising to businesses that also advertised on a competing radio station. [Citation to *Lorain Journal*.] Similarly, in *Chase Mfg., Inc. v. Johns Manville Corp.*, 84 F.4th 1157 (10th Cir. 2023), which approvingly cited *Lorain*, a monopolist manufacturer of calcium silicate was found liable for refusing to deal with businesses that bought calcium silicate from a new market entrant. Indeed, the doctrinal conditions established in *United States v. Colgate & Co.* 250 U.S. 300, 307 (1919), and reaffirmed in *Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398 (2004), do not appear to prevent such applications. In *Chase*, the Tenth Circuit even stated that the district court erred in relying on the refusal-to-deal-with-rivals caselaw in this non-rival context. *Chase Mf'g, Inc.*, 84 F.4th at [pincite needed] Furthermore, several commentators urge a more robust application of the doctrine in platform industries where access or interconnection is indispensable to competition. The underlying rationale is that once a platform operator vertically integrates downstream, it gains an incentive to foreclose downstream competitors by restricting essential access. *See, e.g.*, HERBERT HOVENKAMP, FEDERAL ANTITRUST POLICY: THE LAW OF COMPETITION AND ITS PRACTICE 386, 389 (7th ed. 2024). The same logic should extend to a platform that subordinates its interests to a powerful hub. Although the platform and the hub are not formally integrated, the platform's heavy reliance on the hub may prompt exclusionary behavior analogous to that observed in vertical integration.

[116] Under this framing, the market is two-tiered, with upstream "competition organizers" and downstream "competition participants." Each organizer competes as a "buyer" of competition participants (among teams or individual players), and then as a "seller" of the competition to consumers directly (live gate) or indirectly (through broadcasters). Stephen F. Ross, *An Antitrust Analysis of Sports League Contracts with Cable Networks*, 39 EMORY L.J. 463, 507–09 (1990). Individual chess players thus

chess players,[117] rendering the ban on Niemann potentially exclusionary conduct that amounts to illegal monopolization designed to eliminate a nascent rival.[118] His conduct could thus be framed either as an indirect refusal to deal with a rival or as a conditional, direct refusal to deal with platforms that reject his demands— though it is probably best understood as pressuring platforms to foreclose access to Niemann.

Under current doctrine, however, each of these framings would unfortunately be difficult to pursue, since courts have set a remarkably high legal threshold for establishing a refusal-to-deal claim. Under *Colgate*,[119] market participants are generally free to exercise their independent discretion as to whom to deal with. An exception exists where the refusal to deal is done with the "purpose to create or maintain a monopoly."[120] The Supreme Court's

---

offer their "participation services" to the upstream organizers. A boycott effectively forces an organizer to choose which competitor to allow, to the detriment of consumers who prefer a competition featuring the best possible competitors.

[117] Carlsen can be likened to elite athletes. Such athletes can enjoy significant bargaining/countervailing power due to the scarcity of their unique talent, especially when combined with celebrity branding which creates strong fandom. *See, e.g.*, Sherwin Rosen, *The Economics of Superstars*, 71 AM. ECON. REV. 845 (1981); Ross, *supra* note 109, at 507–09. Notably, the individualized character of chess games- wherein each player generally plays for himself - strengthens a top player's bargaining power relative to a top player in a team sports, especially when fans generally follow teams or leagues. *Id.* When the market is bilaterally concentrated, with a small number of buyers (platforms and tournament organizers) and a small number of sellers (elite players), both sides have potential for strategic bargaining. *Id.* While courts have not recognized players in teams as holding monopoly power, because players cannot exclude rivals from labor markets or set prices unilaterally as those are determined by league policies or collective bargaining, *e.g.*, *Robertson v. NBA*, 556 F.2d 682 (2d Cir. 1977); *Am. Needle, Inc. v. NFL*, 560 U.S. 183 (2010)), chess players are more similar to elite fighters (e.g., in MMA). Courts have acknowledged that individual top tier fighters may be indirectly affected by monopsony contracts that restrict market access and suppress earnings, *Le v. Zuffa, LLC*, No. 2:15-cv-01045-RFB-BNW, 2023 WL 5085064 (D. Nev. Aug. 9, 2023).

[118] Courts have long found that under certain conditions inducements of third parties to exclude a rival may amount to anticompetitive exclusionary conduct under § 2. *See, e.g.*, *United States v. Microsoft Corp.*, 253 F.3d 34, 58 (D.C. Cir. 2001) (en banc) (per curiam); *Conwood Co. v. U.S. Tobacco Co.*, 290 F.3d 768 (6th Cir. 2002).

[119] Under *Colgate*, a firm could lawfully announce its intention to sell only to those who charge a specified price and then refuse to sell to anyone who disobeyed. Both the announcement and the subsequent refusal are seen as unilateral acts rather than a vertical agreement. *See* Herbert Hovenkamp, *Antitrust and Digital Refusals to Deal*, NETWORK L. REV. (2025).

[120] *Colgate & Co.* 250 U.S. at [pincite needed]

Trinko[121] decision is commonly read as further narrowing the prohibition, recognizing only a narrow exception under *Aspen*[122] that prohibits a super-dominant firm from terminating prior cooperation with a rival without legitimate justification.[123] This narrow interpretation limits the ability to extend the prohibition to also encompass indirect refusals or those coerced by third parties, especially where the monopolistic hub and its foreclosed rival never had a direct commercial relationship.[124] Furthermore, courts might be reluctant to recognize even significant hub power—such as Carlsen's—as amounting to monopoly power.

Allowing Niemann's refusal-to-deal claims to prevail, however, seems like a desired outcome. Carlsen and Niemann share a unique economic relationship: they are not only rivals competing for popularity and monetary rewards through their participation on chess platforms, but also complements who, alongside other elite players, jointly contribute to the production of top-level chess. Ongoing interaction between elite competitors is therefore essential for generating the high-quality games that create value for spectators and, by corollary, for the platforms and tournament organizers. These platforms and organizers also govern the terms of this interaction, incentivized to preserve it as a driver of industry value, though as demonstrated hub power could distort their decisionmaking. Consequently, Trinko's concerns regarding the administrability of compelled cooperation between rivals and the risk of chilling investments[125]—which are central to its skepticism toward the Aspen exception[126]—are considerably less salient in this context. Likewise, characterizing Carlsen's conduct as a vertical refusal to deal with platforms that refuse to comply with his demand to exclude Niemann clarifies how Carlsen prevents platforms from accessing an input that would enhance the quality of their offerings. Such conduct might also be characterized as a "secondary

---

[121] See, e.g., *Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398 (2004); Hovenkamp, *supra* note 112 ("*Trinko* made U.S. antitrust challenges to refusals to deal close to impossible."). For criticism see, e.g., Erik Hovenkamp, *The Antitrust Duty to Deal in the Age of Big Tech*, 131 YALE L.J. 1385 (2022).

[122] *Aspen Skiing Co. v. Aspen Highlands Skiing Corp*., 472 U.S. 585 (1985).

[123] We leave for future discussion the possibility that a wider interpretation of the refusal to deal prohibition will be applied through Section 5 of the FTC Actin accordance with the Policy statement, *supra* note 88, at 13–16 (listing "discriminatory refusals to deal which tend to create or maintain market power" as an example of "Conduct that violates the spirit of the antitrust laws" and pointing to historical cases and scholarship that apply or suggest a wider interpretation).

[124] Carlsen's refusal to deal is not directed at Niemann but rather at mitigating third parties.

[125] *Trinko, LLP*, 540 U.S. at 408–09.

[126] *Id.* at n. 111.

refusal to deal,"[127] wherein a node (in this case, a smaller hub) cannot supply its product without vertical access to a platform, yet faces exclusion from that platform due to the hub's ultimatum.[128] This suggestion for widening the refusal to deal prohibition is strengthened by the fact that given the unique facts of this case, other monopolization prohibitions do not seem to apply.[129] Resultantly, the hub can skip antitrust condemnation for its unilateral action.

3. *Ripple Effects: A Stylized Example*

Unilateral hub(uses) are not always overt. They can involve devilishly intricate manipulations of network dynamics that generate extensive ripple effects throughout platform ecosystems, underscoring the pressing need for understanding and evaluating their competitive effects. We exemplify this by analyzing a paradigmatic stylized case.

Consider the following hypothetical scenario involving a major food chain (McBurger), and a food-delivery platform (Grubdash). Grubdash holds a monopoly position in food delivery. As a condition for operating on Grubdash's platform, McBurger demands that Grubdash entirely waive its

---

[127] This draws on Hovenkamp's distinction between primary and secondary refusals to deal. Primary refusals deny rivals access to a monopolist's core asset, posing a direct threat to its investment. Secondary refusals involve integration into complementary markets where access to that core asset is withheld. Hovenkamp argues that courts should be more receptive to intervention in such secondary cases. *See* Hovenkamp, *supra* note 115.

[128] Alternatively, Carlsen's conduct might be captured under Daniel Fancis' proposed offense of "conditional dealing," whereby a monopolist offers benefits and penalties, or bribes and threats, to induce trading partners to refrain from competing against the monopolist, or from dealing with rivals Daniel Francis, *Monopolizing by Conditioning,* 124 COLUM. L. REV. 1917 (2024).

[129] Despite the exclusionary effects of Carlsen's conduct, other prohibitions of unilateral conduct also do not seem to apply in our case. For example, Carlsen's conduct does not involve two product operating in distinct markets, as required by tying case law. *See, e.g*., *Jefferson Parish Hosp. District No. 2 v. Hyde*, 466 U.S. 2, 21 (1984). Similarly, the prohibition of exclusionary dealing is not a good fit. Carlsen demands the exclusion of a specific rival, therefore not foreclosing competition in the market for all other players. Yet in *Microsoft* the court found that although forecosure need not foreclose all outlets, it should help keep usage of rivals below the critical level necessary for *any rival* to pose a real threat to the monopoly. *United States v. Microsoft Corp.*, 253 F.3d 34, 67 (D.C. Cir. 2001). We leave for future research whether section 5 of the FTC Act, especially under its recent wide interpretation, could be interpreted to apply. *See generally* FED. TRADE COMM'N, *supra* note 88.

commission fee for McBurger's transactions.[130] Grubdash agrees, recognizing that McBurger's presence would significantly increase its platform's appeal. To subsidize the direct costs of serving McBurger, Grubdash recalibrates its fees, raising commission rates for all other participating nodes that lack the hub power—and thus the bargaining power—to secure comparable fee exemptions. Grubdash might be able to do so because the addition of McBurger to its network would increase its market power and the network value to other platform participants.[131]

Antitrust's primary lens for scrutinizing GrubDash's calibrated fee structure lies in the prohibition on price discrimination. Yet existing law is unlikely to prohibit GrubDash's conduct on this basis. The principal statute governing price discrimination—the Robinson-Patman Act[132]—does not apply because (inter alia) it covers only the sale of commodities, placing services like those offered by GrubDash outside its scope.[133] Theoretically, section 2 of the Sherman Act may also apply if the price discrimination generates exclusionary effects to McBurger's rivals.[134] But this path faces both doctrinal and

---

[130] To demonstrate the power a major food supplier might wield against food-delivery platforms, see Alicia Kelso, *McDonald's Inks Deal with DoorDash, Ending Exclusivity with Uber Eats*, RESTAURANTDIVE (Jul. 17, 2019), https://www.restaurantdive.com/news/mcdonalds-inks-deal-with-doordash-ending-exclusivity-with-uber-eats/558901/.

[131] *See, e.g.*, Roman Inderst & Tommaso M. Valletti, *Buyer Power and the 'Waterbed Effect'*, 59 J. INDUS. ECON. 1 (2011).

[132] Robinson-Patman Act, 15 U.S.C. §§ 13(a)–(b), 21a (2006). Although this prohibition has faced sustained criticism and had fallen out of favor with enforcement agencies for decades, *see, e.g.*, Daniel J. Gifford & Robert T. Kudrle, *The Law and Economics of Price Discrimination in Modern Economies: Time for Reconciliation*?, 43 U.C. DAVIS L. REV. 1235 (2010), the Khan-led FTC recently applied it. *See, e.g.*, FTC Press Release, FTC Sues Southern Glazer's for Illegal Price Discrimination, December 12, 2024, https://www.ftc.gov/news-events/news/press-releases/2024/12/ftc-sues-southern-glazers-illegal-price-discrimination?utm_source=chatgpt.com. This scenario also fits uneasily under § 1 of the Sherman Act because McBurger's fee waiver agreement is not contingent on any price change—or anticompetitive harm—affecting other platform participants.

[133] Purdy Mobile Homes, Inc. v. Champion Home Builders Co., 594 F.2d 1313, 1317 (9th Cir. 1979).

[134] Note by the United States, *Price Discrimination*, DAF/COMP/WD(2016)69 (OECD, 2016), at 4, https://one.oecd.org/document/DAF/COMP/WD(2016)69/en/pdf. Section 5 of the Federal Trade Commission Act might also apply, especially given its wide interpretation in the FTC's current Policy Statement, FED. TRADE Comm'n, *supra* note 88, at 8–9, 13–14 (listing price discrimination as a type of conduct that potentially "violates the spirit of the antitrust laws" and can therefore be deemed "unfair" and condemnable under Section 5—even

conceptual limitations. Doctrinally, the longstanding reliance on Robinson-Patman has left the Sherman Act's framework for addressing price discrimination largely underdeveloped.[135] More fundamentally, the exclusive focus on exclusionary effects toward McBurger's rivals may fail to capture the full impact of the dynamics unfolding across the network.

First, as in Niemann's lawsuit, such a focus misdirects enforcement away from the true instigator of the anticompetitive conduct—McBurger—and instead targets Grubdash, even though the latter may prefer to resist the demand yet lacks the power or the incentive to do so. While targeting the platform might strengthen its resistance incentives, platforms often lack sufficient leverage over hubs to make this approach effective.

Second, it is far from straightforward that the fee waiver excludes rivals. Network science teaches us that this depends on three key parameters: the volume of transactions McBurger's competitors lose when raising prices to offset higher fees; the viability thresholds for their continued platform participation; and the likelihood that the increased fees would trigger a cascade of departing platform participants. Moreover, even if the fee waiver does push some competitors out, one must also account for McBurger's contribution to Grubdash's network externalities. McBurger's presence may enhance the platform's appeal, thereby expanding Grubdash's overall network size and generating positive spillovers for other suppliers. Thus, the net effect on competitors is not necessarily negative. This underscores the need for an analysis that comprehensively captures the intricate platform dynamics at play.

Perhaps the most interesting aspect, however, is that the focus on McBurger's competitors neglects how network dynamics can propagate harm to other participating nodes within Grubdash's network. The ripple effects may begin with end-consumers: McBurger's competitors, facing elevated platform fees, may pass some or all of these increased operational costs on to consumers through higher meal prices.[136] This situation would provide McBurger with a strategic opportunity—to raise its own prices in parallel, transforming the waiver from a cost-saving benefit into a price-hike burden for consumers. Notably, the fee waiver may extend far beyond the market

---

when it falls outside the scope of other antitrust statutes, specifically the Sherman and Clayton Acts. To be condemned, such conduct must "tend to negatively affect competitive conditions—for instance, by raising prices, reducing output, limiting choice, lowering quality, reducing innovation, impairing other market participants, or reducing the likelihood of potential or nascent competition." [Suggest pincite here.]

[135] Note by the United States, *supra* note 127.

[136] *Cf.* United States v. Am. Express Co., 88 F.Supp. 3d 143, 216–17 (2015 (finding that AmEx's merchant restraints caused merchants to raise retail prices to all customers, including those who shop with cash, food stamps, etc.).

where McBurger operates, affecting other markets in which Grubdash is active. Assume that Grubdash delivers not only food but also other goods, like beauty products, and that it subsidizes McBurger's fee waiver by increasing costs for all suppliers. As a result, the effects might cascade into the seemingly unrelated beauty product market, and other markets where the platform operates. Moreover, the potential for other non-rival powerful hubs like Ulta Beauty (a cosmetics retailer) to demand similar waivers risks triggering recursive price increases throughout the platform ecosystem. This example illuminates how network dynamics can lead to cross-market impacts, propagating harm across disparate markets in ways that existing antitrust frameworks fail to capture.

Despite such price increases, enforcers would encounter substantial barriers when seeking judicial redress. Any successful litigation against McBurger's unilateral conduct based on its alleged exclusionary effects would be contingent upon proof of its monopoly power in the market in which it operates—a stringent legal threshold not automatically met by its hub power. Customers of McBurger's competitors or of sellers of other goods, such as Ulta, who are affected by the price hike will be in a distinctively disadvantaged position: they would not be able to sue McBurger, as they are neither direct nor indirect consumers of McBurger.[137] And their natural targets for a lawsuit—Grubdash or McBurger competitors or sellers of other goods—would be out of reach if their elevated prices are not exclusionary. Antitrust laws do not prohibit excessive pricing, as such.[138] But even if they did,[139] a lawsuit will fail if the price increases merely neutralize the financial impact of the fee waiver without enhancing profit margins.

Can one rely on a market-based solution in which Grubdash's low-degree nodes—whether consumers or small merchants—migrate to competing platforms such as Grubhub or Uber Eats? As network science and platform economics teach us, such inter-platform migration is often severely constrained. Price differentials alone may not suffice to overcome the network effects binding most suppliers and consumers to Grubdash Furthermore, platforms

---

[137] Indirect consumers generally do not have antitrust standing. Ill. Brick Co. v. Ill., 431 U.S. 720 (1977). Many states have rejected the Illinois Brick rule for purposes of their own state antitrust laws. *See. e.g.*, Calif. v. ARC Am. Corp., 490 U.S. 93 (1989).

[138] *See, e.g.*, Michal Gal, *Monopoly Pricing as an Antitrust Offense in the U.S. And the EC: Two Systems of Belief About Monopoly?*, 49 ANTITRUST BULL. 343 (2004):

[139] The door for such an interpretation has been opened by the FTC in its current Policy Statement. *See* FED. TRADE COMM'N, *supra* note 88. We leave for future research whether Section 5 of the FTC Act will be interpreted by courts to prohibit exploitative prices, as such.

often operate in oligopolistic markets in which hubs multi-home across all competing platforms to reach a broader customer base. If a multi-homing hub successfully negotiates preferential concessions from each competing platform, smaller participants might find themselves without viable alternatives.

***

The above analysis leads to several conclusions regarding the appropriate legal framework. First, where platforms are involved, simplistic analyses of firm conduct do not suffice; the full impact of the network must be considered to ensure the law achieves its objectives. Second, legal focus should also capture the instigating hub even if it lacks a monopoly position in its market. Doing so captures the ripple effects across interconnected markets and participants, revealing the broader systemic impacts of practices like the fee waiver in our example. It also cuts through the rigid antitrust requirements of precisely and painstakingly defining market boundaries and competitor classifications, identifying instead how the hub's influence propagates through the network and affects other nodes. Finally, network science underscores the importance of exercising caution in regulatory interventions in networks. In our Grubdash example, suppose Grubdash's viability is contingent upon McBurger's presence on its platform, and that prohibiting Grubdash from granting such a fee waiver could lead McBurger to abandon Grubdash. By contrast, permitting McBurger to demand—and Grubdash to grant—a fee waiver might generate superior results for both the platform and its other nodes, including merchants and consumers. Admittedly, this scenario represents an extreme boundary case; platforms rarely exhibit existential dependency upon individual hub participation. Nevertheless, it illustrates the imperative for measured prudence when formulating regulatory responses to strategic conduct.

B. COORDINATED HUB POWER

The second category of the exercise of hub power involves coordinated multilateral conduct. To illustrate the significance of network science in analyzing such conduct, we examine the landmark e-book price-fixing case, *United States v. Apple*,[140] in which Apple and major publishers coordinated to shift the industry from Amazon's wholesale pricing model to an agency model. The court found, or at least assumed, a hub(use), although it obviously did not employ this terminology. Yet, as our analysis reveals, this conclusion does not necessarily hold under a deeper examination through the lens of network science.

---

[140] United States v. Apple, Inc., 791 F.3d 290 (2d Cir. 2015). Our analysis disregards the cultural, psychological and social roles that books play in our society, focusing solely on economic effects.

This sub-part demonstrates three important points: hub power can be augmented through coordination among hubs, such augmentation challenges ingrained legal assumptions, and not all exercises of hub power are necessarily anticompetitive.

1. United States v. Apple*: Facts and Court Decisions*

On November 19, 2007, Amazon launched the Kindle e-reader. To drive its adoption, it offered new releases and bestsellers at $9.99, below wholesale cost.[141] This strategy proved highly effective, and by the time Barnes & Noble introduced a competing e-reader in 2009, Amazon controlled approximately 90% of the e-book market.[142] While e-book sales were still a small segment of the overall book market,[143] Amazon's aggressive discounting disrupted traditional publishing practices. The major publishing houses (the "Big Six")[144] feared Amazon's loss-leader strategy would not only undermine print sales, but permanently reset consumer price expectations, threatening their business model.[145] More fundamentally, they worried that Amazon's growing market power could force lower wholesale prices or even enable direct author publishing, potentially displacing publishers entirely.[146]

These existential concerns drove the Big Six to seek ways to counter Amazon's increasing dominance in digital distribution. Recognizing that no single publisher possessed sufficient power to singlehandedly mount effective resistance against Amazon's Kindle dominance, they explored various

---

[141] *Id.* at 299.

[142] *Id.*

[143] *Id.*; *see also* Richard J. Gilbert, *E-Books: A Tale of Digital Disruption*, 29 J. ECON. PERSP. 165, 166 (2015) (noting that while e-book sales in the U.S. grew swiftly after Amazon introduced the Kindle, by 2013 they still accounted for just 20.8% of revenues and 23.8% of unit sales across all books).

[144] The term "Big Six" refers to the six largest publishers in the U.S.: Hachette, HarperCollins, Macmillan, Penguin, Random House, and Simon & Schuster. In 2010, their titles accounted for over 90% of the New York Times bestsellers in the U.S. *Apple, Inc.*, 791 F.3d at 298. In 2013, Penguin and Random House merged to form Penguin Random House, turning the Big Six into the Big Five. Press Release, *Bertelsmann Welcomes Antitrust Clearance of Penguin Random House by the U.S. Department of Justice*, BERTELSMANN (Feb. 14, 2013), https://www.bertelsmann.com/news-and-media/news/bertelsmann-welcomes-antitrust-clearance-of-penguin-random-house-by-the-u.s.-department-of-justice.jsp?atn=2862171&abp=2862171,2862218.

[145] *Apple, Inc.*, 791 F.3d, at 299–300.

[146] *Id.*; *see also* Gilbert, *supra* note 143, at 174 (describing the publishers' concern that they might be sidelined in the book industry as Amazon increasingly dealt directly with authors, and the share of self-published books accounted for a larger share of e-book sales and online sales of printed books). In April 2013, five of the ten best-selling e-books were self-published. Gilbert, *supra* note 142, at 174.

collective strategies.[147] They unsuccessfully attempted to pressure Amazon to change its retail pricing for e-books by raising wholesale prices, and even considered developing a competing e-book platform.[148] Their most significant coordinated response was "windowing"— delaying the release of e-book versions until months after hardcover publications.[149] However, this strategy proved counterproductive, sacrificing their position in the expanding e-book market and damaging overall sales.[150]

Enter Apple. In early 2009, Apple identified a strategic opportunity in the e-book market, recognizing that the iPad's multi-functionality could offer a competitive edge over the single-purpose Kindle.[151] For maximum impact, Apple planned to launch the iBookstore alongside the iPad. To do so it needed to secure a critical mass of books quickly. It focused on the Big Six, soon discovering their concerns regarding Amazon's $9.99 pricing model. This created a natural alignment of interests—the publishers sought leverage against Amazon's low pricing, while Apple wanted prices to be sufficiently high to ensure profitability while sufficiently low to compete effectively with Kindle.[152]

Apple offered book publishers to shift from the traditional wholesale model to an agency model, where publishers set iBookstore retail prices and received 70% of sales, with Apple taking a 30% commission. While this guaranteed Apple's profitability, it risked making the iBookstore uncompetitive if publishers set prices significantly above Amazon's $9.99. The solution was twofold. First, Apple imposed price caps on all e-books, although these had to exceed Amazon's $9.99 price benchmark. Second, it demanded that publishers agree to a most-favored-nation ("MFN") clause, requiring them to match any lower prices they offered elsewhere, effectively eliminating retail price competition.[153]

Apple approached each of the Big Six with identical e-book agency agreements, assuring them that they were all being offered the same terms.[154] Although the combination of Apple's commission and the MFN clause reduced publishers' per-sale revenue, it was conceived as a means to jointly force Amazon to accept the agency model and to eliminate its $9.99

---

[147] *Apple, Inc.*, 791 F.3d at 300.
[148] *Id.*
[149] *Id.*
[150] *Id.* at 300–01.
[151] *Id.* at 301.
[152] *Id.* at 301–02.
[153] *Id.* at 303–04.
[154] *Id.*

pricing.[155] Apple made it clear its market entry was conditional upon Amazon adopting agency pricing and on the iBookstore securing agreements with five of the Big Six publishers.[156] With five publishers coming to terms,[157] Steve Jobs unveiled the iBookstore alongside the iPad. When questioned about the iBookstore's $14.99 price point versus the Kindle's $9.99, Jobs revealed the strategy by stating publishers would withhold books from Amazon due to their dissatisfaction with Amazon's pricing, ensuring price parity.[158]

Amazon initially resisted, removing Macmillan's print and e-book titles from its site after the publisher threatened to substantially delay releases if its demand for a switch to agency pricing was not met.[159] However, Macmillan strategically informed Apple and publicly disclosed the conflict to authors and agents. When Hachette and Penguin joined the pressure campaign, Amazon, facing this coordinated publisher resistance, was forced to surrender pricing control.[160]

The U.S. government and several states sued Apple and the publishers.[161] While the publishers quickly settled,[162] Apple proceeded to trial. Both district and appellate courts found Apple violated § 1 of the Sherman Act by orchestrating a conspiracy to restrict competition in the "trade e-books market"[163] and raise retail e-book prices.[164] The appellate court, in particular, examined the case through a crude network framework—the hub-and-spoke theory—with Apple as the hub coordinating the publisher spokes.[165] The court held that Apple's vertical publisher agreements enabled horizontal coordination among publishers, warranting condemnation both as an unreasonable restraint and under the *per se* prohibition of horizontal price-fixing.[166]

---

[155] *Id.* at 305.

[156] *Id.* at 305–06.

[157] Random House refused Apple's terms. *Id.* at 308.

[158] *Id.*

[159] *Id.*

[160] *Id.* at 308–09.

[161] For an in-depth analysis of the case *see* CHRIS SAGERS, UNITED STATES V. APPLE: COMPETITION IN AMERICA (2019).

[162] *Apple, Inc.*, 791 F.3d at 311–12.

[163] *Id.* While both parties agreed on this market definition, its validity is questionable. For example, in *United States v. Bartlesmann SE & Co. KGaA*, 646 F.Supp. 3d 1, 24–25 (D.D.C. 2022), a more granular market—for publishing rights to anticipated top-selling books—was considered.

[164] *Apple, Inc.*, 791 F.3d at 311.

[165] *Id*. Note that the term "hub" refers to the platform itself in a coordinated conduct context like *Apple*, a different usage than in our context.

[166] *Id.* at 313–14.

Importantly, the appellate court emphasized that "Apple's quest to have a critical mass of publishers join the iBookstore"[167] depended on its ability to organize them to act collectively against Amazon.[168] The court explained that "[w]hile no one Publisher could [a]effect an industry-wide shift in prices or change the public's perception of a book's value, if they moved together they could,"[169] and that consequently Apple's "proposed [c]ontracts would entice a critical mass of publishers only if these publishers perceived an opportunity collectively to shift Amazon to agency."[170]

Commented [AG5]: should this not be affect?

2. United States v. Apple*: Applying Network Science*

Notably absent from the courts' analysis is any consideration of network effects, despite their central role in the e-book industry. Both Kindle and iBookstore are two-sided platforms, connecting authors and readers. Although the case was decided in 2015—well after the *Microsoft* cases established the significance of network-driven market power[171]—the courts make no reference to either network effects or other concepts that emerged as central in *Microsoft*, including lock-in (where switching to a competitor would incur prohibitive costs) or tipping (the point at which the advantage accruing to a product or service from network effects eclipses the ability of other suppliers to compete).[172] This oversight is particularly striking in light of Amazon's 90% market share in this fast-growing market.

Given this omission, we reassess the court's decision by applying network science to e-book platforms. This lens enables us to examine how network properties shape market dynamics and inter-platform competition within the e-book ecosystem.

The network topology of e-book platforms consists of nodes that represent the platform participants (readers, authors, and publishers), and links that represent transactional relationships through e-book sales, whether mediated by publishers or conducted by authors directly on the platform. For readers, the appeal of an e-book platform relies on the immediate availability of a broad selection of desirable books, while authors and publishers are incentivized to publish on platforms that offer maximum exposure to potential readers. Figure 7 depicts this graphically.

---

[167] *Id.* at 305.

[168] The court emphasized this point in response to Apple's claim that it had merely 'unwittingly' facilitated the publishers' joint conduct and was not part of the horizontal conspiracy. *Id.* at 316.

[169] *Id.* at 305.

[170] *Id.* at 317.

[171] *See* Agranat & Gal, *supra* note 17.

[172] Agranat, *supra* note 19, at 214–15.

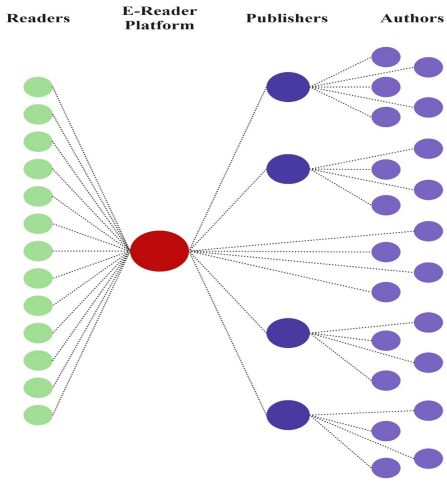

FIGURE 7: AN E-BOOK PLATFORM

The technological innovations embodied in Amazon's e-reader, as well as its pricing strategy, enabled Amazon to establish a formidable network-effects moat of readers, publishers and authors. This dominance was reinforced by its power as a retailer in the adjacent print book market and by its substantial financial resources.[173] It was further bolstered by the fact that the initial investment in an e-reader was substantial, with the first Kindle launching at $399 in 2007,[174] and Barnes & Noble's Nook—the Kindle's first major competitor—debuting at $259 in 2009.[175] This significant upfront cost implied that consumers would realize value from their device purchase only if they bought and read enough e-books from the relevant platform to justify the investment, thereby creating a strong lock-in effect for the chosen platform.[176]

Yet Amazon's network-driven dominance had a key vulnerability: the Big Six publishers functioned as critical *hubs* within Kindle's network. Let us analyze the publishers' hub power versus Amazon (hub vs. platform) using the framework set out in Part II.2 above. Authors prefer established

---

[173] See Gilbert, *supra* note 143, at 172 (noting that Amazon accounted for at least 30% of all book sales in both print and digital formats).

[174] Saul Hansell, *Amazon Pitches a Wireless Ipod for Books*, N.Y. TIMES (Nov 19, 2007), https://archive.nytimes.com/bits.blogs.nytimes.com/2007/11/19/amazon-pitches-a-wireless-ipod-for-books/.

[175] Jeffrey A. Trachtenberg & Geoffrey A. Fowler, *B&N Reader Out Tuesday*, WALL ST. J. (Oct 20, 2009), https://www.wsj.com/articles/SB10001424052748703816204574483790552304348.

[176] Gilbert, *supra* note 143, at 171–72.

publishers, especially the Big Six, due to their superior resources and capabilities. Authors often rely on advances from their publishers—upfront payments against future royalties—to support themselves. These advances are considered the single most important term in publishing contracts, as they often represent the only compensation an author may receive for their work.[177] As the Big Six are better positioned to offer substantial advances, authors tend to prefer to submit manuscripts to them.[178] These publishers also offer high quality services like design and editing,[179] and possess significant marketing capabilities.[180] More crucially, their reputational capital not only signals quality to prospective authors,[181] but might also serve as a quality indicator that broadens audience reach. In network science terms, this means that major publishers possess higher *fitness* than smaller ones and that the mechanism of *preferential attachment*—where authors prefer to publish through major publishers and readers prefer to buy from them—enhances their ability to attract additional links.[182] As a result, these publishers became central hubs within the platforms' network. Accordingly, the Big Six possessed significant *hub attractiveness* through their ability to aggregate authors and readers.[183]

Amazon, in turn, had a certain *platform dependence* on these hubs to maintain its network integrity. In particular, a coordinated publisher exodus, while damaging to the publishers, risked triggering a *cascading failure* that could decimate the Kindle's network, especially during the pivotal period of shifting reader preferences and market formation. Indeed, this dependence was evidenced by the publishers' ability to challenge Amazon through wholesale price increases and windowing tactics without severe consequences. However, the publishers' hub power faced two key limitations. First, no individual publisher wielded sufficient hub power to trigger network failure, as demonstrated by Amazon's willingness to remove Macmillan's titles. Second, prior to Apple's entry, the lack of a viable alternative platform for publishers meant low *switching feasibility*, undermining the credibility of exit threats.

As noted, the Big Six, recognizing the limitations of their individual hub power, initially contemplated creating their own e-book platform. Apple's

---

[177] United States v. Bertelsmann SE & Co. KGaA, 646 F.Supp. 3d 1, 13–14 (2022).

[178] *Id.* at 13–15, 19.

[179] *Id.* at 19–20.

[180] *Id.*

[181] Indeed, successful authors who first publish with smaller publishers often prefer to publish their next book with a Big Five publisher. *Id.* at 20–21 & n.11.

[182] *See* Part II.2.A, *supra*.

[183] *Id.*

market entry provided an alternative solution. However, to successfully challenge Kindle's established network and lock-in effects, Apple needed a critical mass of content. In line with our newfound understanding of the role of hubs on networks, Apple's strategy centered on *hub-plucking*[184]—strategically enticing at least five of the Big Six publishers as a collective unit to offer their books on its network at competitive prices. Apple hoped that consumers would appreciate the increased multifunctionality of the iPad, resulting in a (partial) transfer of the Big Six's network value to the iBookstore.[185] But to successfully hub-pluck the Big Six, Apple confronted[186] a pricing dilemma. It could pay publishers higher wholesale prices and offset this by raising retail prices for readers. However, Amazon's below-cost retail pricing made this approach unfeasible, as it gave the iBookstore minimal flexibility to raise prices while staying competitive. This left Apple with two options: operate the iBookstore at a loss, which it rejected, or arrange things so that the publishers would force Amazon toward pricing levels that were more sustainable for Apple.[187]

Given these network-driven competitive dynamics, we argue that the court's application of a *per se* prohibition is overly simplistic, disregarding the complex interplay between network effects, hub power, and inter-platform competition in determining market outcomes. Rather, given Amazon's strong market power, the fact that each of the Big Six could not fight Amazon's below-price policy on its own, and that absent their coordinated conduct

---

[184] *See* Agranat, *supra* note 19. This strategy is not fail-proof. As an example, consider the unsuccessful attempt by the streaming service Mixer to challenge the dominance of rival Twitch through an exclusive contract with the popular streamer and professional gamer Richard Tyler Blevins ("Ninja"). Despite securing Ninja's migration from Twitch, Mixer failed to catalyze sufficient network effects to displace the incumbent platform, ultimately resulting in Ninja's return to Twitch's more robust ecosystem. Tramel Raggs, *Fortnite Star Ninja Leaves Twitch to Stream on Microsoft's Mixer*, WASH.25 POST (Aug. 1, 2019), https://www.washingtonpost.com/sports/2019/08/01/fortnite-star-ninja-leaves-twitch-stream-microsofts-mixer/; Natalie Jarvey, *Superstar Gamer Tyler "Ninja" Blevins Return to Twitch (Exclusive)*, HOLLYWOOD REP. (Sep 10, 2022), https://www.hollywoodreporter.com/news/general-news/superstar-gamer-tyler-ninja-blevins-returns-to-twitch-exclusive-4057872/.

[185] In 2010, the Big Six together accounted for over 48% of all e-books sales in the United States, and over 90% of all New York Times Bestseller book sales. United States v. Apple Inc., 952 F.Supp. 2d 638, 648 & n.5 (S.D.N.Y 2013); *Apple, Inc.*, 791 F.3d at at 298 & n.13. This dominance has lingered to this day. For example, in 2021, the Big Five together held nearly 60% of the market for the sale of trade books, and 91% of the market for anticipated top-selling books. United States v. Bertelsmann SE & Co. KGaA, 646 F.Supp. 3d 1, 12, 27 (2022).

[186] Agranat, *supra* note 19; Gal & Agranat, *supra* note 13.

[187] *Apple, Inc.*, 791 F.3d. at 301–02.

Apple would most likely not be able to enter the market, we argue that a rule of reason analysis would have been more appropriate.[188] Under such an approach, the court would weigh the agreement's anticompetitive effects against its procompetitive benefits to determine whether it unreasonably restrains trade.[189]

Indeed, a simplistic application of a *per se* rule in a case involving the competitive dynamic of hub-plucking, which is relatively unknown to antitrust decision-makers, may not be in line with Supreme Court precedent regarding the application of *per se* rules. As the Court has cautioned, "[i]t is only after considerable experience with certain business relationships that courts classify them as per se violations."[190] Yet the experience underlying the *per se* prohibition applied here is inapposite, as it is rooted in experience that does not acknowledge the networked implications of hub power and its effects on inter-platform rivalry. Indeed, departing from *per se* condemnation in novel settings is well within precedent, as exemplified by *United States v. Microsoft* case, where the court declined to apply such a rule to tying, in light of the unprecedented technological integration at stake.[191]

Focusing on the agreement's ability to overcome Amazon's network-effects moat and promote long-term inter-platform competition would have also been in the spirit of foundational cases such as *Chicago Board of Trade*[192] and *BMI*,[193] which recognize that agreements—including those involving price restraints between competitors—might be lawful if they are necessary to promote competition. Procompetitive virtues may include enabling the creation of a viable competitor capable of entering or challenging a concentrated

---

[188] Other commentators have criticized the case's condemnation of Apple and the publishers on similar grounds. *See, e.g.*, John B. Kirkwood, C*ollusion to Control a Powerful Customer: Amazon, E-Books, and Antitrust Policy*, 69 MIA. L. REV. 1, 3–5 (2014). Yet, by merely emphasizing the need to counter Amazon's substantial monopoly power and allegedly predatory pricing, their critique is not unique to network markets. Our analysis adds this dimension, using network science to underscore the case's distinctive networked features, in which network effects increasingly entrench Amazon and coordination among platform participants—specifically through coordinated hub-plucking—may be imperative to breach the resulting network effects moat and foster inter-platform competition.

[189] *See, e.g.*, *Chi. Bd. of Trade v. United States,* 246 U.S. 231 (1918).

[190] Broad. Music, Inc. v. CBS, Inc., 441 U.S. 1,t 9 (1979) (quoting United States v. Topco Assocs., Inc., 405 U.S. 596, 607–08 (1972)).

[191] United States v. Microsoft Corp., 253 F.3d 34, 84 (D.C. Cir. 2001) (en banc) (per curiam).

[192] *Chi. Bd. of Trade*, 246 U.S. at 238 ("The test of legality is whether the restraint imposed is such as merely regulates, and perhaps thereby promotes, competition, or whether it is such as may suppress or even destroy competition.").

[193] *Broad. Music, Inc.*, 441 U.S..

market.[194] While the case law typically focuses on agreements that facilitate market entry of their parties (e.g., a buying cooperative of small retailers designed to counteract the purchasing power of large chains[195]), the same logic should extend to agreements with third-parties that enable them to enter the market.

Accordingly, an open-minded, full-scale rule-of-reason inquiry would have been better suited to address the complexities of this case. Although one of the judges who condemned Apple allowed for a quick-look assessment following the *per se* condemnation,[196] as the dissenting judge noted, beginning the analytical process with a *per se* approach likely skewed the quick-look assessment.[197] A proper full rule-of-reason inquiry would have examined realistic entry options for competitors who were "as efficient as" Amazon, thereby reorienting the focus from short-term consumer harm manifested through price increases towards an assessment of how entry barriers could be overcome, while simultaneously safeguarding consumer and author welfare. Such an analysis would also have evaluated the agreement's price effects,

---

[194] *See, e.g.*, *Chi. Bd. of Trade*, 246 U.S. (recognizing market entry facilitation, noting that the restraint "increased the number of country dealers engaging in this branch of the business" and "enabled country dealers to do business on a smaller margin" by eliminating risks and transaction costs that would otherwise prevent their effective participation). With regard to vertical restraints, see, e.g., the landmark *Continental T.V. v. GTE Sylvania, Inc*., 433 U.S. 36 (1977) (stating that vertical territorial restrictions can be procompetitive when they "actually had a procompetitive effect in that it enabled a marginal producer to achieve the status of a viable competitor in an industry threatened by oligopolistic tendencies."); *see also* John M. Newman, *Procompetitive Justifications in Antitrust Law*, 94 IND. L.J. 501 (2019).

[195] Nw. Wholesale Stationers, Inc. v. Pac. Stationery & Printing Co., 472 U.S. 284 (1985).

[196] United States v. Apple, Inc., 791 F.3d 290, 329–30 (2d Cir. 2015).

[197] *Id.* at 349. While we argue for the application of the rule of reason in this setting, we acknowledge the criticisms relating to its complexity and expense, which tend to favor defendants, as plaintiffs struggle to meet demanding economic proof requirements. *See, e.g.*, Andrew I. Gavil & Steven C. Salop, *Probability, Presumptions and Evidentiary Burdens in Antitrust Analysis: Revitalizing the Rule of Reason for Exclusionary Conduct*, 168 U. PA. L. REV. 2107 (2020). However, this criticism does not justify the mechanistic application of simplistic per se prohibitions grounded in theory and experience that diverge substantially from the dynamics of platforms characterized by hubs. In time, as antitrust jurisprudence and scholarship deepen their understanding of these intricate competitive dynamics, new legal rules—such as tailored presumptions or prohibitions—could be developed to more effectively address these complexities, thereby reducing plaintiffs' burdens. We leave this important discussion for future work.

focusing not only on the short run, but also on the long run.[198] It would have included an inquiry[199] into whether Amazon's low cost pricing strategy was likely to be sustainable in the long run, or whether its prices would likely increase if Apple could not enter. The latter could have occurred either because Amazon's initial strategy constituted the first stage of a below-cost predatory conduct designed to exclude rivals, or it was a short-term mechanism to stimulate e-book demand in an emerging market. It should have also analyzed the effects of Amazon's strategy on the quality of books, the technological development of e-book readers, and the overall user experience of the e-book format. Accordingly, the fact that the increase in prices to the final consumers, at least in the short run, was part of the Big Six's object, should have been analyzed in a wider context. This more sophisticated approach was echoed in Judge Jacobs's dissenting opinion, which criticized the majority's failure to adequately consider how Amazon's conduct impacted Apple's ability to enter the market.[200] Furthermore, had the analysis shown that the agreement was essential for Apple's entry, and given the novelty of the analysis of hub-plucking in antitrust, the DOJ could have pursued a consent decree enabling entry while constraining restrictive provisions, such as limiting the agreement's duration.

Moreover, network science reveals that, topologically speaking, publishers function as platforms-within-a-platform, aggregating authors before connecting them to readers through the e-book distribution platforms. This exposes a potential logical inconsistency in the court's analysis: if antitrust law enables authors to consolidate their bargaining power through individual publishers, thereby creating countervailing market power vis-à-vis dominant book retailers,[201] it seems inconsistent to categorically prohibit publishers from collectively exercising countervailing power vis-à-vis e-book platforms. This inconsistency is especially puzzling when considering publishers'

---

[198] Many commentators maintain that dynamic efficiency is more important than static efficiency in terms of overall consumer welfare. *See, e.g.*, David J. Teece, *Pivoting toward Schumpeter: Makan Delrahim and the Recasting of U.S. Antitrust Towards Innovation, Competitiveness, and Growth*, ANTITRUST BULL., Summer 2018, 32; Rebecca Allensworth, *Long-Run Consumer Welfare*, VAND. L. REV. (forthcoming 2025).

[199] We leave for future research questions regarding burdens of proof and whether the court can address such issues absent the parties' pleading.

[200] United States v. Apple, Inc., 791 F.3d 290, 340–42 (2d Cir. 2015).

[201] Antitrust sometimes incorporates the competitive effects of countervailing power, often in the form of buyer power. *See, e.g.*, U.S. DOJ & FTC, MERGER GUIDELINES § 2.10 (2023); PETER C. CARSTENSEN, COMPETITION POLICY AND THE CONTROL OF BUYER POWER: A GLOBAL ISSUE (2017); John B. Kirkwood, *Buyer Power and Exclusionary Conduct: Should Brooke Group Set the Standards for Buyer-Induced Price Discrimination and Predatory Bidding?*, 72 ANTITRUST L.J. 625 (2005); John B. Kirkwood, *Powerful Buyers and Merger Enforcement*, 92 B.U. L. REV. 1485 (2012).

concerns that Amazon's conduct might eliminate them altogether.[202] Such an outcome might not be competitively advisable. Eliminating the publishers from Amazon's e-book ecosystem would have diminished the feasibility of hub-plucking,[203] thereby raising existing entry barriers and strengthening Amazon's ability to exploit both readers and authors while deterring potential competitors. Such market consolidation might also have additionally enabled Amazon to fortify its position within the physical book retail segment, compounding the anticompetitive harm. Consequently, categorically prohibiting publishers from using their collective hub power to counteract Amazon's market power, risked further entrenching an already formidable incumbent platform whose market position that may already be exceedingly difficult to dislodge. In such a situation, the mere fact that the collective resistance was orchestrated by Apple—itself a potential competitor to Amazon—through a hub-and-spoke contractual arrangement should not have automatically triggered *per se* condemnation.

In short, in markets characterized by platforms exhibiting hubs, a formalistic application of *per se* rules risks overlooking critical long-term competitive implications. While the court aimed to protect Amazon's low e-book pricing (which might have been predatory), blocking Apple's entry paradoxically may have allowed Amazon to later raise prices[204]—potentially to levels exceeding those that would have prevailed in a more competitive environment. The court's singular focus on short-term price effects also neglected broader industry considerations, including author and publisher incentives affecting content quality and variety, and innovation in e-reader technology. While it is difficult to determine all causes, Amazon still reportedly maintains, to this day, dominance in the e-book market.[205] A network-science perspective would have also yielded more suitable market-wide solutions with greater promise for long-term competition, such as device interoperability

---

[202] *Apple, Inc.*, 791 F.3d at 300.

[203] Interestingly, top-selling authors can also constitute significant hubs on e-book platforms. Remarkably, the top 4% of profitable titles, often by top-selling writers, generate a staggering 60% of the book industry's profits. United States v. Bertelsmann SE & Co. KGaA, 646 F. Supp. 3d 1, 13 (2022).

[204] *In re* Amazon.com, Inc. eBook Antitrust Litig., No. 21-cv-00351 (GHW) (VF), 2022 WL 4581903 (S.D.N.Y. Aug 3, 2022).

[205] *Id.* at *1 (noting that, according to the plaintiffs' complaint, Amazon accounted for almost 90% of all U.S. eBook sales). In September 2020, Amazon's eBook share in the U.S. was estimated to stand at 76%. Jeffery A. Trachtenberg, *Amazon, a Longtime E-Book Discounter, Is Accused of Driving Up the Price of E-Books*, WALL ST. J. (Jan 15, 2021), https://www.wsj.com/articles/amazon-a-longtime-e-book-discounter-is-accused-of-driving-up-the-price-of-e-books-11610748615?mod=hp_lista_pos4. According to the dissent in *United States v. Apple*, Apple's entry reduced Amazon's e-book market share from 90% to 60%. *Apple, Inc.*, 791 F.3d at 341.

requirements, potentially separating hardware and e-book-store competition to reduce lock-in.

In addition, the categorical prohibition of coordinated hub-power exercise designed to counterbalance dominant platform influence creates perverse incentives that compel market participants to pursue consolidation through mergers as the sole viable mechanism for establishing countervailing market power. In fact, the dominance of the Big Six publishers emerged largely as a result of such mergers.[206] Yet restricting the creation of countervailing power to mergers carries significant drawbacks. Most importantly, mergers might enable the exercise of combined hub power not only against the dominant platform but also against every other player in the ecosystem, including authors, readers, and even less powerful publishers. This broad-based power concentration can harm precisely those market participants that antitrust law seeks to protect. In contrast, permitting carefully structured arrangements that facilitate joint hub power deployment specifically against dominant platforms preserve competitive dynamics among participating hubs in their relationships with less powerful market participants, thereby maintaining the competitive pressures necessary to safeguard author, reader, and smaller publisher interests. This approach recognizes that different competitive relationships within complex network markets may require distinct regulatory treatment, allowing for strategic coordination where necessary to address platform dominance while preserving beneficial competition where market power disparities are less pronounced.

Finally, the truncated network perspective applied in cases involving coordinated hub power fails to provide a holistic perspective on how antitrust law should regulate networked industries. As a result, decisions may be somewhat inconsistent. To illustrate, the *Apple* decision[207] effectively entrenched Amazon's dominance, positioning it to potentially harm publishers and, indirectly, authors. Moreover, to the extent that Amazon succeeded in sidelining the publishers, the decision would have facilitated Amazon's ability to harm both authors and readers even further.[208]

---

[206] *Bertelsmann*, 646 F. Supp. 3d at 12.

[207] *Apple, Inc.*, 791 F.3d.

[208] In contrast, the proposed (then blocked) Penguin Random House–Simon & Schuster merger was aimed at safeguarding authors' interests. *Bertelsmann*, 646 F. Supp. 3d at 23. The decision's narrow focus on the compensation of top-selling authors without considering the networked nature of the industry disregarded the broader, long-term implications for inter-platform competition, innovation in e-readers and e-books and the interests of readers. On the development of "enhanced" e-books with augmented functionality, see Angus MacWilliams, *The Engaged Ereader: A Human-Centered Evaluation of Ebook User Experience*, 29 PUBL'G RSCH. Q. 1, 3–4 (2013), https://doi.org/10.1007/s12109-013-9305-8.

C. UNILATERAL CONDUCT HARNESSING AGGREGATE POWER

Network science illuminates a third category of cases: unilateral conduct by non-dominant firms that harnesses aggregate power, resulting in concerted conduct. Importantly, these concerted effects emerge organically from the network's structure and hub dynamics, rather than overt coordination, leading to interesting questions regarding legal liability. To illustrate such effects, we analyze a stylized case involving the global distribution systems ("GDS") industry.

1. *GDS Platforms: Industry Characteristics*

GDSs are two-sided platforms that operate in the travel industry, connecting travel service providers, such as airlines, car rental companies and hotels, with travel agents.[209] Airlines provide information about their booking inventory, including prices and availability, while the GDS grants them access to a powerful distribution channel—the network of travel agents. Travel agents in turn can efficiently access, compare, and make immediate confirmed reservations from hundreds of airlines through a single centralized interface.[210] The global GDS market features three major providers—Amadeus, Sabre, and Travelport—that have comparable turnover, global market share, and numbers of participating airlines.[211] To streamline the analysis, we assume these providers are identical in both characteristics and market power, and operate independently without collusion.

GDSs play a central role in the global travel industry.[212] While agents can book flights directly through airline websites, the direct-booking option is an

---

[209] Case No. COMP/M.4253 *Travelport/Worldspan* (21.8.2007), at ¶¶ 10–11. For simplicity, this article will focus exclusively on airlines and travel agents.

[210] *Id.* at ¶¶ 11–12; Stefano Vannini, *Bargaining and Two-Sided Markets: The Case of Global Distribution Systems (GDS) in Travelport's Acquisition of Worldspan*, 2 COMP. POL'Y NEWSLETTER 43, 44 (2008).

[211] TRAVEL TECH. ASS'N, https://www.traveltech.org/global-distribution-systems. For a comparison of the GDS platforms' characteristics see Commission of the European Communities, *Proposal for a Regulation of the European Parliament and of the Council on a Code of Conduct for Computerized Reservation Systems,* IMPACT ASSESSMENT {COM(2007) 709 SEC(2007) 1497} (2007), at 44 (Annex I). Notably, local market shares are not always equal. For example, Sabre has maintained the largest GDS platform in the United States, with a market share exceeding 50%. US Airways, Inc. v. Sabre Holding Corp., 938 F.3d 43, 50 (2d Cir. 2019).

[212] Hinnerk Gnutzmann & Piotr Spiewanowski, *Did the Lufthansa Group GDS Surcharge Stimulate Direct Online Sales? A Causal Analysis*, 7 E-REV. TOURISM RSCH. 1 (2016); Stephan Bingemer, *Back to the Future with IATA NDC? Critical Turning Points in the History of Airline Distribution*, 4 J TOURISM FUTURES 205, 213 (2018).

inadequate substitute for GDS-mediated transactions, due to GDS advantages in functionality and network effects.[213] Direct booking requires travel agents to establish and maintain multiple airline connections, continuously aggregate pricing data, and develop comparison tools, all of which translate into high transaction costs, especially in the pre-AI-agents era.[214] Airlines face similar constraints. Despite the potential for cost reductions through the elimination of GDS booking fees, the extensive network reach and embedded market position of GDS platforms limits their ability to redirect large booking volumes.[215] The same holds true for travel agents. Although tickets may be cheaper on some airlines' websites, travelers consult agents primarily because they believe agents have superior information, due, in part, to their access to comprehensive flight information through GDS systems.[216] These conditions led the EU Commission to define a distinct GDS product market,[217] a definition we adopt for the purposes of this article.

Airlines typically multi-home by subscribing to all three GDSs. Consequently, each GDS offers broadly similar content to travel agents, reducing the added value for agents of subscribing to multiple GDSs. Agents therefore generally opt for a single GDS.[218]

Finally, GDSs play a key role in facilitating two types of inter-airline arrangements that are crucial to the travel industry.[219] *Codesharing* allows an airline to place its designator code on a flight operated by another airline and sell tickets for that flight.[220] For instance, both American Airlines and Delta may sell tickets for the same American Airlines flight. On such flights, airlines act simultaneously as collaborators and competitors. *Interlining* involves commercial joint ventures between airlines that allow one airline to sell services provided by another airline, facilitating the handling of passengers traveling on itineraries requiring multiple flights.[221] Airlines use interlining to sell itineraries they could not serve alone. As with code-sharing,

---

[213] Vannini, *supra* note 210, at 44–45.

[214] *Travelport/Worldspan*, *supra* note 202, at ¶¶ 34–35, 54.

[215] *Id.* at ¶¶ 36, 48–50.

[216] *Id.* at ¶ 54.

[217] *Id*. ¶ 58.

[218] *Id.* at ¶15; *US Airways, Inc.*,938 F.3d at 51; Vannini, *supra* note 210, at 43, 46.

[219] See Steer Davies Gleave, *Competition Impact of Airline Code-Share Agreements* (Final Report prepared for the European Commission Directorate General for Competition, 2007) ¶¶ 5.11–.12, 5.18–.20.

[220] *Code Sharing*, U.S. DOT (March 13, 2020), https://www.transportation.gov/policy/aviation-policy/licensing/code-sharing.

[221] IATA, *The Future of Interline: A New Model for Seamless Customer Journeys* 1, at 3–6 (2019), https://www.iata.org/contentassets/23426d4b09a0446dbe831601869098a1/future-of-interline-wp.pdf.

airlines often compete within these arrangements since either airline can typically sell tickets for the entire route. Importantly, travel agents depend exclusively on GDS platforms to access the information needed to facilitate both types of arrangements.[222]

Building upon these facts, the following Part analyzes a stylized case study that exemplifies the potential for unilateral conduct harnessing aggregate power within network-based industries. It is inspired by a real-world case, which was not made public. To address confidentiality concerns, the names of the parties involved have been omitted, and certain facts have been modified.

2. *GDS Platforms: A Stylized Case*

A major global airline ("Block Air") demands that several small travel agencies agree to modified commercial terms, or lose the ability to book its flights, whether directly or through GDS platforms. The modified terms require the agencies to forfeit their marketing service fees. Upon rejecting the modified terms, the agencies find their operations severely impaired. Their GDS terminals show drastically reduced route options, with Block Air's actions not only eliminating access to its own inventory but also restricting the ability to view and book any itineraries involving interline or codeshare arrangements with Block Air. Recognizing the severe implications of this network-wide disruption on their ability to compete, the agencies attempt negotiations before ultimately initiating antitrust litigation against both Block Air and GDS providers, contending that the airline's actions effectively darkened substantial portions of the GDS network.

Block Air defends its actions, asserting they were purely unilateral and devoid of any collusion. It claims to have no knowledge regarding how its decision to restrict access to its own flight inventory would affect the broader availability of competing airlines' services through GDS platforms, while simultaneously denying that it had requested such extensive blocking functionalities from the GDSs.

Central to Block Air's defense is its assertion that absent monopoly power on any individual route,[223] it retained full discretion in selecting trading partners and negotiating contractual terms. From this perspective, the travel

---

[222] Bingemer, *supra* note 212, at 213; Interviews with Travel Agents ([suggest including dates per Bluebook rule 17.2.5])..

[223] While the question of how to define the relevant markets in the airline industry is complex, it has been suggested that each route could be considered a separate market. Jose Azar et. al., *Anticompetitive Effects of Common Ownership*, 73 J. FIN. 1513, 1514 (2018).

agents' rejection of Block Air's modified terms provided sufficient justification for restricting access to its flights, regardless of any resulting network-wide effects that might disadvantage other market participants.

The GDSs argue that the extensive network impact was an unintentional and unanticipated consequence of their systems' underlying algorithmic architecture. Remedying these effects would require substantial technical resources. Echoing the airline's position, they emphasize the absence of any coordination or collusion that led to the blocking outcome. They further argue that the equal distribution of market shares among GDS providers precludes finding monopoly power in the GDS market.

For the purposes of this article, let us assume that the broad blocking effect was indeed an entirely inadvertent technological byproduct of the GDS systems' architecture, with all three GDS systems sharing similar architectures. Furthermore, neither Block Air nor any of the GDS providers held a monopoly position in their shared markets, yet over 50% of flights worldwide were booked through GDSs during the relevant period.

3. *GDS Platforms: Applying Network Science*

From a network-topology perspective, GDS platforms connect two types of nodes, namely airlines and travel agents, with links representing air-travel transactions. Major airlines function as powerful hubs within these networks. Figure 8 illustrates the GDS network graphically. The upper portion illustrates the two-sided nature of the GDS platform and its role as an intermediary that connects airlines, travel agents, and, by extension, passengers. The lower section zooms in on the GDS network, presenting a simplified scenario in which travel agents book flights from both small, low-degree and major airlines. The larger circles represent hubs, which accordingly account for a higher volume of booked flights.

Commented [JN6]: Just flagging that it's really hard to read the small text in this figure when I printed the article out.

Commented [JR7R6]: Nick will work on.

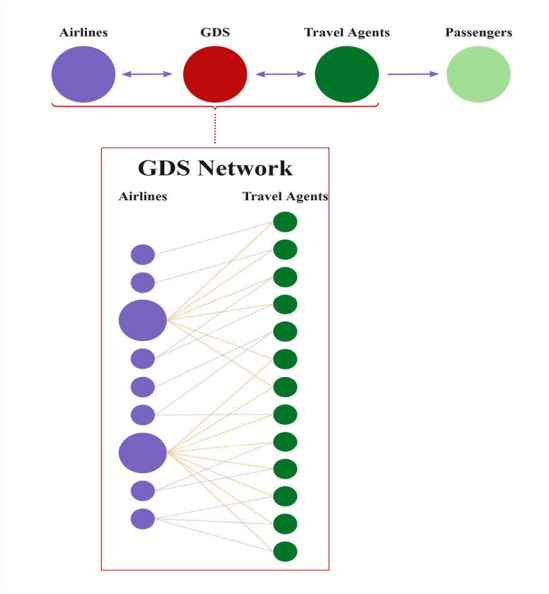

FIGURE 8: THE GDS ECOSYSTEM

Major airlines' *hub attractiveness* derives from both fitness advantages and preferential attachment dynamics. Their *fitness* stems from scale economies enabling extensive route networks, while *preferential attachment* arises from strong brand recognition, creating a feedback dynamic where larger passenger bases facilitate fleet expansion, broader route offerings, enhanced scheduling flexibility, and more attractive loyalty programs. Interestingly, while the major airlines' hub power in network-science terms relates to their importance to the stability of the network, it is amplified by the fact that they operate physical airport hubs where their carriers concentrate flights and coordinate passenger connections. Their scale advantages further enable superior disruption management and facilitate extensive codesharing and interlining partnerships with other carriers.

Empirical data confirms major airlines' hub status within these networks. Even among the top twenty-five of the 348 carriers that are members of the International Air Transport Association ("IATA"),[224] significant disparities exist. In 2019 the top five airlines averaged 142.1 million passengers annually, while those ranked 20th to 25th averaged 87 million, with presumably

[224] IATA, *Current Airline Members*, https://www.iata.org/en/about/members/airline-list/).

much lower figures for airlines ranked towards the bottom.[225] Fleet size data similarly demonstrate hub dynamics.[226] This concentration of passengers and fleet capacity also bolsters major airlines' ability to participate in interline and codeshare flights.

Recognizing the hub power of major airlines within GDS platforms enables us to characterize our stylized case as one in which a major hub (Block Air) leverages its extensive role in the air travel industry to deny low-degree nodes (small travel agents) access to its flight inventory. More importantly, the underlying GDS network topology enables Block Air to extend the blocking effect beyond its proprietary inventory to encompass the offerings of its numerous collaborative partners engaged in codesharing and interlining arrangements, thereby darkening a substantial portion of the GDS network, essentially amounting to a group boycott. Figure 9 graphically exemplifies this dynamic from a travel agent's perspective. Circles represent airlines and links illustrate interlining and codesharing partnerships. The orange circles indicate the darkened parts of the network.

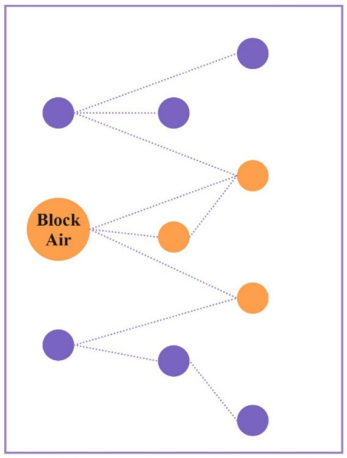

FIGURE 9: THE DARKENING EFFECT CREATED BY PARTNERSHIPS

[225] IATA, WORLD AIR TRANSPORTS STATISTICS 19 (2019), https://www.iata.org/contentassets/a686ff624550453e8bf0c9b3f7f0ab26/wats-2019-mediakit.pdf.

[226] Benjamin Zhang, *The 20 Biggest Airlines in the World, Ranked*, BUS. INSIDER (Mar. 6, 2019), https://www.businessinsider.com/biggest-airlines-world-oag-2019-3#1-american-airlines-20.

Given the widespread darkening of the GDS networks caused by Block Air, one might expect the GDS platforms to take action against the airline's conduct. After all, the value of the GDSs' networks fundamentally hinges on their ability to offer access to desired flights. By applying our framework for evaluating hub power and examining the countervailing dynamics within GDS ecosystems, we can uncover the constraints that hinder GDS intervention.

First, multi-homing behavior exhibited by airlines—whereby carriers maintain simultaneous presence across all three major GDS platforms—creates a high level of *platform dependence* on major airlines. This, in turn, implies that a major airline's withdrawal from any single GDS immediately compromises that platform's competitive viability.

To demonstrate how a major airline's withdrawal from a single GDS can generate profound cascading disruptions across the network, consider the following hypothetical scenario. Assume that the GDS platform is configured such that, for codeshare flights, the operating carrier is responsible for updating flight information. A medium-sized airline, MidAir, has a codeshare agreement with the smaller airline MiniJet, under which MidAir operates a flight while both airlines sell tickets for it. Following a dispute with a GDS provider, MidAir withdraws from the platform and ceases to use it to share real-time flight data. When maintenance issues force MidAir to ground the plane designated for the shared flight, the GDS platform is not updated in real-time. The flight information will only be updated once MiniJet learns of the cancellation, either through notification from MidAir or via the other GDSs—a slower process that might require human intervention. In the meantime, a travel agent logging into the blinded GDS might book tickets for canceled flights through MiniJet.

This scenario underscores the consequences a GDS platform faces when deprived of real-time data on major airlines' flights. With major airlines operating numerous flights and maintaining extensive collaborations with other carriers, accurate and timely information about cancellations and even delays is crucial for a GDS platform's functionality. Competition among travel agents is intense, leaving little room for error. Travel agents cannot risk booking flights with high cancellation probabilities, as such missteps would drive travelers to competitors. Such booking failures also erode the GDS platform's credibility and appeal.

The disruption does not necessarily end there. Information lags in GDS systems could trigger a chain reaction that propagates through all of MiniJet's collaborations, ultimately affecting airlines with no direct partnership relationships with MidAir. Consider a scenario where MiniJet planned to use the canceled codeshare flight as the initial segment of an interline route operated jointly with Iberia—a carrier that maintains no direct codeshare or interline

partnerships with MidAir. When MidAir's cancelled flight disrupts MiniJet's service, it simultaneously affects MiniJet's ability to fulfill its interline commitment with Iberia. Though Iberia's flight segment could be booked independently, its flight's economic viability depends on passengers connecting from MiniJet's flight under their interline agreement, leading Iberia to cancel the connecting flight. However, the delayed update about MidAir's cancellation in the GDS implies that agents might still book Iberia's segment before it is cancelled. As Iberia's flight may connect to other carriers' routes, the disruption ripples outward. This dynamic illustrates how major airlines' extensive partnership networks enable localized disruptions to snowball across the system. This asymmetric dependency relationship fundamentally alters the bargaining dynamics between the major airline and each GDS.

The second source of hub power arises from the fact that the airlines' practice of multihoming not only increases platform dependence but also enables high *switching feasibility*. Unlike platform migration for travel agents whose single-homing practices require major adjustments, content withdrawal by airlines entails minimal technical modifications and can be quickly reversed upon reaching favorable terms in renegotiations. Although such withdrawals can temporarily reduce airline revenues, the impact is softened by their continued presence on other GDS platforms and their direct booking channels.

These hub power dynamics limit the incentives of a GDS to intervene on behalf of minor travel agents, as it could not afford to jeopardize its relationship with key airlines who are vital to the network's cohesion. Coordinating responses between GDS platforms to countervail the hub power of Block Air would face significant practical and legal—including antitrust—challenges. Minor airlines would also face difficulties in mounting effective resistance, given their limited resources and network dependence that ties smaller airlines to larger carriers.

Other major airlines, negatively affected by the cascading network effects, might, however, be incentivized to pressure Block Air to reverse its decision (hub vs. hub), or to pressure the GDS to redesign the system (hub vs. hub via platform). Interestingly, the exact characteristics that allow Block Air to harness the network's power to exert pressure on the travel agencies also empower airlines to push back, even without concerted action—unless, of course, they wish to retain such network-darkening power for their own hub(uses).

This stylized case leads to an important conclusion: hub power can transcend traditional metrics of market power such as market shares. Rather, hub power may depend on the relative number of links and the centrality of the hub within a network.

4. *Antitrust Implications*

Turning to the antitrust implications of our analysis, consider a scenario wherein GDS platforms deliberately enable major airlines to darken the flight inventories of their collaborative partners, with the airlines recognizing and strategically exploiting this functionality. Such circumstances would constitute a paradigmatic hub-and-spoke conspiracy subject to rigorous antitrust scrutiny.[227]

The stylized case, however, presents a more complex legal challenge, exposing a fundamental analytical gap in traditional antitrust law's capacity to address network-based harm. The absence of concerted action between Block Air and other airlines or with the GDS providers precludes liability under antitrust statutes prohibiting collusion.[228] Initially, the impact of Block Air's actions was either unintentional or unknown; and even when the GDSs and Block Air became aware of the issue, they appear to have had legitimate reasons for refusing to address it. The GDSs are either technologically unable to resolve the systemic vulnerability, or must invest significant resources to do so. Moreover, once the GDSs and other major airlines call on Block Air to cease its block, Sherman Act § 1 condemnation, which is conditioned on the existence of a concerted agreement, becomes highly inappropriate.

Monopolization prohibitions seem inapplicable because no actor holds monopoly power.[229] Block Air, by itself, does not command such power. And even if one of the GDSs held such power on its own, it is not clearly the true instigator of the problem, and even if it were, it would have legitimate justifications for refusing to remedy the situation. This creates a paradox in which significant competitive harm unfolds in plain sight yet falls outside the scope of existing legal frameworks designed to safeguard market competition.

Yet this case creates a compelling intuition that it merits antitrust scrutiny. The broad blocking effect not only mirrors the competitive harm typically associated with concerted refusals to deal, but its unilateral character renders it potentially more pernicious than traditional coordinated conduct. The absence of inter-firm coordination requirements enhances both the feasibility of implementation and the durability of the anticompetitive strategy, as no ongoing maintenance of agreements or monitoring for defection is necessary. The risk escalates when considering the potential for other airlines to adopt similar unilateral tactics, effectively darkening entire GDS networks

---

[227] *See* 15 U.S.C. § 1; United States v. Apple, Inc., 791 F.3d 290, 314 (2d Cir. 2015). ; Howard Hess Dental Lab'ys Inc. v. Dentsply Int'l, Inc., 602 F.3d 237, 255 (3d Cir. 2010).

[228] 15 U.S.C. § 1.

[229] *Id.* § 2.

through a handful of individual actions. This situation therefore exposes a significant blind spot in the ability of contemporary antitrust doctrine to address emerging forms of anticompetitive practice.[230] Current legal frameworks, predicated largely on distinguishing between unilateral and coordinated behavior, may prove inadequate to capture the sophisticated ways in which dominant market participants can exploit network vulnerabilities to achieve anticompetitive outcomes through ostensibly independent actions.

We therefore suggest that Block Air should be subject to scrutiny under the monopolization prohibitions,[231] on the grounds that the airline is harnessing both its own hub power and the power of its collaborating partners, even though the resultant disruption is not in their interest.[232] Most importantly and in line with our conclusion above, assessment of Block Air's market power should be expanded beyond its own offerings to include its ability to unilaterally build upon the power of other network participants.[233] This broader framework would better capture the airline's true capacity to distort competition through network effects. Block Air would then face increased scrutiny to prevent its network-leveraging conduct from becoming anticompetitive monopolization. Note that while this would prohibit Block Air from using technological means to deny travel agents access to its inventory, the airline would still retain the option to prevent such bookings through contractual or tortious measures.

In theory, such heightened responsibilities should also apply to minor airlines that, while lacking unilateral hub power, can similarly harness the collective power of their collaborators—even if these collaborators are fewer in number. In practice, however, the likelihood that a minor platform participant could effectively harness the power of additional participants is unrealistic. Indeed, if a minor airline—even one with many collaborating partners—were to initiate a blocking action, each collaborator would likely be in a far

---

[230] For a related concern, see C. Scott Hemphill & Tim Wu, *Parallel Exclusion*, 122 YALE L. J. 1182 (2012).

[231] 15 U.S.C. §§ 2; § 45; FED. TRADE COMM'N, *supra* note 84.

[232] Such hub power, albeit the result of harnessing the market power of multiple participants, is distinguishable from the often-rejected concepts of "shared monopoly" or "collective dominance" in duopoly or oligopoly markets. *See, e.g.*, George A. Hay, *Oligopoly, Shared Monopoly, and Antitrust Law*, 67 CORNELL L. REV. 439 (1982). This is because the exercise of market power in our case does not depend on any sort of accommodating response by over platform participants and is rather a action.

[233] *See* Noga Blockstein-Shchory & Michal S. Gal, *Market Power Parasites: Abusing the Power of Digital Intermediaries to Harm Competition*, 35 HARV. J. L. TECH. 73 (2021) (stating that small firms can increase their own market power by acting as parasites of the power of platforms).

better position to respond from a business perspective, for example cancel interlining and codesharing agreements, thereby rendering antitrust intervention unnecessary.

We conclude this Part by offering a table that summarizes examples of exercises of hub power, organized by the type of hub power and target of the hub(use). Examples cited in this article are referred to in parentheses. Real cases and controversies are presented in italics; examples or stylized cases are presented in plain text.

TABLE 1: EXAMPLES OF HUB(USES) ORGANIZED BY TARGET AND SOURCE OF HUB POWER

Target /Source of hub power	Unilateral	Coordinated	Unilateral harnessing aggregate hub power
Hub vs. hub	**Indirect via nodes:** *James Charles/Tati Westbrook* (III.1.A) **Indirect via platform and/or third parties:** *Joe Rogan/Neil Young–Spotify* (III.1.A)	**Direct:** Major airlines demand that Block Air cease its conduct, or they will stop codesharing with it (III.3.B)	**Direct:** Block Air, with many codeshare agreements, threatens to darken a GDS to pressure another major airline to join such agreements
Hub vs. node	**Direct:** A large social media influencer (mis)informs followers about a product (III.1.A) **Indirect:** Grubdash/McBurger (motivation: raising rivals' costs; III.1.B)		**Indirect**: A Block Air threatens to block its flights on the GDS unless a travel agency increases its payments (III.3.B)
Hub vs. platform	**Direct:** Grubdash/McBurger (motivation: demanding better conditions; III.1.B) **Direct:** *Davitashvili/Grubhub* (III.1.B)	**Direct:** *Big Six/Apple* (III.2)	
Hub vs.	**Indirect:** A large media influencer		**Indirect via platform:** A major

third party	influences followers to stop buying a product not sold on the platform		airline demands GDS not contract with a new travel agency

CONCLUSION

With platforms' socio-economic effects soaring to unprecedented heights, the need for sound governance over their ecosystems has never been more critical. Antitrust jurisprudence has thus far largely oversimplified the underlying mechanics of intra-platform dynamics, overlooking the capacity of hubs operating on platforms to shape both internal interactions and inter-platform competition. By combining platform economics with in-depth insights drawn from network science's cutting-edge analytical tools, the article delves into the inner workings of platform networks and demonstrates how hub power affects competitive dynamics across a wide range of settings and industries. Its exercise can have profound and far-reaching consequences for the platform itself, its other participating hubs and nodes, and even third parties, potentially spanning multiple platforms and rippling through their networks.

As our research shows, recognizing hub power transforms platform governance by antitrust rules. Such changes span the entire legal process, from evaluating hub power, to identifying anticompetitive hub(uses) and remedying them.

Fusing network science and microeconomics, we propose a systematic, network-based framework for exposing and evaluating hub power. We suggest a four-determinant framework, examining hub attractiveness, platform dependence, switching feasibility, and countervailing power. This framework reveals that hub power cannot be measured by traditional market share metrics—such as simplistic comparisons of nodes' connection counts. We also show how this deeper analysis has significant implications for assessing the market power of platforms.

Our analysis also exposes different manifestations of hub power, offering a preliminary taxonomy of hub(uses). Perhaps most intriguing is the revelation that a single firm can amass hub power by harnessing the influence of other platform participants—even unwittingly or unwillingly—to amplify the impact of its own hub(uses). Importantly, we demonstrate that hub power is not inherently harmful; it can serve beneficial purposes, challenging simplistic regulatory approaches. Consider prominent figures leveraging their influence to push back against unfair, uniform contractual terms imposed by platforms—for example, Taylor Swift's successful pressure on Apple Music to provide royalty payments to artists during the free trial period, which she argued disproportionately harmed emerging artists who relied on that

income.[234] Such cases demonstrate how hubs can help overcome collective action problems and rational apathy that might otherwise allow platform-generated harms to persist.

This nuanced understanding of platform dynamics raises fundamental questions about platform governance, challenging both the simplistic welfare assumptions embedded in our laws and the rigid dichotomies—such as the separation between unilateral and coordinated conduct—that are at odds with the realities of networked industries. It also exposes critical blind spots in contemporary antitrust. A crucial, understudied example concerns platforms' incentives to intervene in conflicts among their participants. Our analysis demonstrates that platforms cannot be relied upon as neutral arbiters in hub-related disputes, given their potentially significant dependence on hubs. This dynamic suggests that market discipline may be insufficient to self-correct hub(uses) in networked environments, underscoring the need for legal intervention.

Recognizing hub power could also facilitate the prioritization of enforcement resources and the determination of appropriate points of intervention. Regulators can leverage network science to identify nodes whose positions and connectivity patterns make them particularly influential in shaping platform dynamics. For instance, monitoring hubs whose effects can easily cascade throughout the network may be more efficient than overseeing all participants.

Finally, recognizing hub power enables us to craft more effective remedies. Traditional remedies often focus on platform-level changes, which can be both overinclusive and underinclusive. Understanding hub power allows for more targeted interventions that address specific problematic network dynamics while preserving beneficial platform features.[235] For example, some platforms might be required to establish clear procedures for resolving hub-node conflicts, limiting the possibility of exercising hub power towards less powerful platform participants. Understanding hub power can also help us design more effective structural remedies to counter platform dominance. For instance, one could consider mandating interoperability with hubs to reduce lock-in effects, thereby increasing the potential for hub-plucking competition. Alternatively, in extreme cases, a court could even consider shutting down or mandating the transfer of certain hubs to facilitate rival platform growth.[236] While such remedies should not be used lightly, they might be appropriate to address intra-platform harm resulting from hub(uses) and promote vibrant

---

[234] Ian Crouch, *Taylor Swift and Apple: Mad Love*, NEW YORKER (June 22, 2015).

[235] *See* Agranat, *supra* note 19, at 259–63.

[236] *Id.*

inter-platform competition. They are also less drastic than alternatives like structural breakups currently being considered to counter harms arising from platform dominance.

Accordingly, the call to recognize hub power demands a fundamental transformation in our approach to platform governance. While this shift is profound, a potential harbinger of this new line of thinking—albeit one that remains only an initial acknowledgment—can be found in the 2023 Merger Guidelines.[237] The guidelines make clear that antitrust agencies must safeguard not only inter-platform competition but also "competition on a platform," emphasizing the risk that arises when a platform acquires one of its own participants.[238] In such cases, the platform may face a conflict of interest resulting from the divergence "between the platform's incentives to operate the platform as a forum for competition and its incentive to operate as a competitor on the platform."[239] Our analysis of hub power reveals that this risk is neither confined to acquisitions nor limited to such conflicts of interests. An influential hub can exert disproportionate influence over the platform's conduct, leading to discriminatory treatment that benefits the hub, despite the platform's preferences. More crucially, the harms from such favoritism are not limited to direct competitors of the hub; they can cascade across the platform, undermining the viability of complementary or otherwise unrelated participants.

In conclusion, our analysis of hub power leverages cutting-edge analytical tools to provide a conceptual framework for understanding a potent form of market power. As platforms continue to expand their role in mediating human interaction, ensuring that hub power serves rather than undermines social welfare becomes a crucial challenge for maintaining healthy networked markets.

We leave for future work empirical studies of additional and potentially more diverse real-world cases where the recognition of hub power and its hub(use) in accordance with our analysis affects the economic and legal outcomes. We also leave for future study the exploration of other tools to limit the abuse of hub power, such as the prohibition of the abuse of superior bargaining power, which was adopted in several jurisdictions.[240] Our next

---

[237] U.S. DOJ & FTC, MERGER GUIDELINES, Guideline 9 (2023).

[238] *Id.*

[239] *Id.*

[240] *See, e.g.*, Act against Restraints of Competition § 20(1)–(2) (Ger.); INT'L COMPETITION NETWORK, TASK FORCE FOR ABUSE OF SUPERIOR BARGAINING POSITION, REPORT ON ABUSE OF SUPERIOR BARGAINING POSITION (2009).

research project seeks to provide an in-depth study of how hub power—alongside other key factors—shapes analyses of platform power.

ABSTRACT

- Research on the market power of platforms and its uses has predominantly focused on the platforms themselves. The article directs attention to an overlooked source of power that profoundly shapes platform dynamics: highly connected *hubs* operating *within* platforms—such as celebrities on social media platforms.
- Drawing on network science and microeconomics, it demonstrates how hubs can exert disproportionate control over interactions and value creation within platform ecosystems, affecting both inter- and intra-platform competition.
- The article develops a novel analytical framework that identifies four key determinants of hub power: hub attractiveness, platform dependence, switching feasibility, and countervailing power dynamics.
- It demonstrates how hub power can fundamentally reshape platform dynamics and their resulting outcomes through detailed case studies—spanning e-books, chess, the air travel industry, and social media and streaming platforms.
- The article demonstrates the wide-ranging antitrust implications of the analysis, across the entire legal process—from identifying efficient intervention points to setting liability standards and crafting remedial measures.