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INTRODUCTION

In a now famous 1996 article Judge Easterbrook wrote that there is no "Law of Cyberspace" any more than there is "Law of the Horse."[1] What he meant is that there is no distinct body of law that concerns itself exclusively with cyberspace any more than there is a distinct body of law that concerns itself with horses. There are laws that regulate the sale of horses, there are laws that regulate what happens when people are kicked by horses, and so on, but there is no law of the horse as such. Similarly, in the cyberspace domain, contracts in cyberspace are regulated by contracts law, torts in cyberspace are regulated by tort law, and so on, but there is no such thing as cyberspace law. The best way—he argued—to understand and regulate "specialized endeavors is to study general rules."[2] In that sense, to paraphrase him, there are no special rules on digital exclusion, i.e. the act of foreclosing from digital markets rivals to increase one's power, any more than there are for digital horses; digital exclusion is regulated by the same rules as exclusion in other markets.

The response came soon enough from Professor Lessig, who, in an equally famous article, wrote that "[w]e see something when we think about the regulation of cyberspace that other areas would not show us."[3] His argument concerned "the limits on law as a regulator" in cyberspace in view of a new source of regulation, namely the code (i.e. the software and hardware) that makes up cyberspace itself.[4] Lessig's claim was not that regular laws do not apply in cyberspace, but that the existence of code as an additional element inherent in cyberspace makes the regulation of cyberspace unique.[5]

As claims and cases against technology giants that foreclose their competitors have recently multiplied,[6] this Article piggybacks on the successful framing of this debate and borrows the core claim of both: the specific tools and rules we use to analyze and regulate exclusionary practices in digital markets are the same as in any other market; we do not need to re-invent the

1. Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 UNIV. CHIC. LEG. FORUM 207 (1996). Easterbrook attributed the phrase to Gerhard Casper, a former dean of the University of Chicago Law School. *See* Jerome H. Skolnick, *Retirement of Sheldon Messinger*, 80 CALIF. LAW REV. 307, 310 (1992).

2. Easterbrook, *supra* note 1, at 207.

3. Lawrence Lessig, *The Law of the Horse: What Cyberlaw Might Teach*, 113 HARV. LAW REV. 507, 502 (1999).

4. *Id* at 502.

5. Lessig clarifies that he does not make a general argument about all specialized areas; just cyberspace. *Id*. at 502.

6. Of the numerous recent appeals to control the monopolistic tendencies of large high technology corporations. See, e.g., Nick Srnicek, *We Need to Nationalise Google, Facebook and Amazon. Here's Why*, THE GUARDIAN, Aug. 30, 2017; Ellen Goodman & Julia Powles, *Facebook and Google: Most Powerful and Secretive Empires We've Ever Known*, THE GUARDIAN, Sept. 28, 2016; Jonathan Taplin, *Can the Tech Giants Be Stopped?*, THE WALL STREET J., July 14, 2017; Editorial, *A Giant Problem: The Rise of the Corporate Colossus Threatens Both Competition and the Legitimacy of Business*, THE ECONOMIST, Sept. 17, 2016.

wheel.[7] However, the function and nature of exclusion in digital markets is affected by the technology-intensive character of such markets in ways that are not encountered in other industries. These considerations are specific to digital exclusion, and work collectively to define every case of exclusion that arises in digital markets. In that sense, digital exclusion is indeed unique and merits special attention.

I am, of course, not the first to point out that exclusion in high technology environments requires a different treatment of some sort. Anticompetitive practices in digital markets have attracted the attention of many influential scholars.[8] But I distinguish the relevant literature from the contribution sought here in two important regards: first, extant scholarship has focused almost exclusively on the economic aspects and special features of exclusion in digital markets, not the technological ones.[9] This is rather surprising, because as a matter of order it is technological capabilities and limitations that define what the transactional overlay can be, not the other way around. Economists start from the premise that "in the beginning there [are] markets,"[10] but in markets where the high technology element is prominent, which market actors, transactional interactions, and options are available, and under which conditions, is largely dependent on what is technically possible.[11] To a large degree technology forms the underlying playing field on

7. *Cf.* Robert Pitofsky, *Antitrust Analysis in High-Tech Industries: A 19th Century Discipline Addresses 21st Century Problems*, 4 TEX. REV. L. POL'Y 129, 133 (1999) ("I believe antitrust should-indeed must-continue to apply. None of the 'high-tech differences' justifies a complete or even substantial exemption."). *See also* Daniel L. Rubinfeld, *Antitrust Enforcement in Dynamic Network Industries*, 43 ANTITRUST BULL. 859 (1998).

8. *See* David J. Teece & Mary Coleman, *The Meaning of Monopoly: Antitrust Analysis in High-Technology Industries*, 43 ANTITRUST BULLETIN 801 (1998); Pitofsky, *supra* note 7; Richard Schmalensee, *Antitrust Issues in Schumpeterian Industries*, 99 AM. ECON. REV. 192 (2000); DANIEL SPULBER & CHRISTOPHER YOO, NETWORKS IN TELECOMMUNICATIONS: ECONOMICS AND LAW (2009); Dennis W Carlton & Michael Waldman, *The Strategic Use of Tying to Create and Preserve Market Power in Evolving Industries*, 33 RAND J. ECON. 194 (2002); Rubinfeld, *supra* note 7; John E. Lopatka & William H. Page, *Antitrust on Internet Time: Microsoft and the Law and Economics of Exclusion*, 7 SUP. CT. ECON. REV. 157 (1999); Daniel E. Lazaroff, *Entry Barriers and Contemporary Antitrust Litigation*, 7 U.C. DAVIS BUS. LAW J. 1 (2001); Nicholas Economides, *Antitrust Issues in Network Industries*, *in* THE REFORM OF EC COMPETITION LAW: NEW CHALLENGES 1, 343-376 (Ioannis Lianos & Ioannis Kokkoris eds., 2010).

9. For a notable exception *see* SPULBER & YOO, *supra* note 8. Yochai Benkler's work is also relevant, notably Yochai Benkler, *Overcoming Agoraphobia: Building the Commons of the Digitally Networked Environment*, 11 HARV. J. L. TECH. 287 (1997).

10. OLIVER E. WILLIAMSON, THE ECONOMIC INSTITUTIONS OF CAPITALISM 87 (1985).

11. *See* Michael G Jacobides, *Industry Change Through Vertical Disintegration: How and Why Markets Emerged in Mortgage Banking*, 48 ACAD. MGMT. J. 465 (2005); Richard N Langlois, *Modularity in Technology and Organization*, 49 J. ECON. BEHAV. ORG. 19 (2002); Jeffrey T. Macher & David C. Mowery, *Vertical Specialization and Industry Structure in High Tech Industries*, 21 ADVANCES STRATEGIC MGMT. 317 (2004).

which business relations are built,[12] and technological capabilities are reflected in transactional and organizational structures ("mirroring hypothesis").[13] To say, for instance, that an integrated dominant firm (e.g. an incumbent telecommunications provider) might be constrained by entry in one of the layers in which it is present (e.g. services and applications), is a judgement on a business/economic outcome of interest to regulators and antitrust courts, which, however, presupposes that the various layers of the production chain have, as a matter of technical feasibility, been decoupled/unbundled so that entry can occur in one layer only instead of the entire value chain, a significantly more difficult scenario, which will attract a wholly different assessment.

The claim that technology serves as the foundation of economic activity in technology-dependent markets, and that therefore it is intricately tied with the regulation of economic activity, is not an implicit adoption of a deterministic view of technology. It is well acknowledged that the direction of technological evolution is infused with socioeconomic and political choices, and that in every design various considerations—technical and non-technical—are embedded and serve as influential determinants of whether a design will be accepted or rejected.[14] But whatever the preparatory work that goes into a design, once formed, it will in turn enable or constrain business practices and opportunities, including exclusionary ones. Not only that, but the technical design may itself incorporate business practices or agreements that used to be performed through the market mechanism (e.g. technical integration in lieu of contractual tying).[15] As technology changes, and enables additional and different designs, so does the competitive fabric of the industry. Therefore, the idea that one can form a complete picture of digital exclusion without accounting for the effect of technology on the competitive conditions in the market is arguably an incomplete analysis. To the contrary, a

12. David D. Clark, John Wroclawski, Karen R. Sollins & Robert Braden, *Tussle in Cyberspace: Defining Tomorrow's Internet*, 13 IEEE/ACM TRANSACTIONS ON NETWORKING 462 (2005) (where the author describes how communications networks should be seen by engineers as designing the playing field, not the outcome).

13. Lyra Colfer & Carliss Baldwin, *The Mirroring Hypothesis: Theory, Evidence, and Exceptions*, (Harv. Bus. Sch. Fin., Working Paper No. 1-124, 2016; Anna Cabigiosu & Arnaldo Camuffo, *Beyond the "Mirroring" Hypothesis: Product Modularity and Interorganizational Relations in the Air Conditioning Industry*, 23 ORG. SCI. 686 (2012); Alan MacCormack, Carliss Baldwin & John Rusnak, *Exploring the Duality Between Product and Organizational Architectures: A Test of the "Mirroring" Hypothesis*, 41 RES. POLICY 1309 (2012).

14. ROBIN MANSELL, THE NEW TELECOMMUNICATIONS: A POLITICAL ECONOMY OF NETWORK EVOLUTION 2-4, 34-38 (1994) (where the author explains that very design consists of rules that forge the relationships among the partaking actors, and even seemingly neutral decisions change the constellation of interactions and redefine the distribution of power among actors).

15. KEVIN COATES, COMPETITION LAW AND REGULATION OF TECHNOLOGY MARKETS 241–42 (2011).

thorough understanding of the industry's technological features that are relevant to antitrust is really the only way to draw economic and policy implications. This Article fills that gap.

The second way by which this study differs from extant literature is that most of the scholarly work so far has focused on specific issues in the analysis of digital exclusion, as opposed to overarching cross-cutting factors.[16] For instance, a line of scholarly work has focused on the steps of exclusion analysis, e.g., how to perform market definition,[17] or how to identify and appreciate efficiencies.[18] Another strand has focused on specific offenses, e.g. predation or tying.[19] Yet a third stream has focused on specific industries, e.g. software[20] or telecommunications.[21] The value of these insights is undisputed, but by maintaining a narrow focus, existing literature tends to sideline broader considerations that define the *overall* function and effects of exclusion in digital markets. Of those, I identify three: first, supply and demand conditions in digital markets that affect sources of competition and substitutability; second, factors and empirical metadata on, the durability of competitive advantage in digital markets; and third, the nature of digital exclusion as a monopolization tactic as contrasted with normal on the merits competition.

These three themes are influential factors in every case of exclusionary practice, because they help determine the ability of the challenged practice to bring about anticompetitive effects, an essential component in antitrust analysis. Indeed, the importance of overarching factors, like the ones above, cannot be overstated. They relate to the broader competitive conditions in the market and therefore are cross-cutting and go beyond each individual step in the analysis of exclusion; they illuminate exclusion's general position in industrial organization, namely the extent to which exclusion is in tension with the competitiveness of (digital) markets; and they can signal to market

16. Many of the articles cited *supra* note 7 discuss in varying degrees of detail general features of digital markets as they pertain to exclusion. But these—to return to my first point—focus on economics, not technology.

17. *See, e.g.*, David Evans & Richard Schmalensee, *Some Economic Aspects of Antitrust Analysis in Dynamically Competitive Industries*, *in* 2 INNOVATION POLICY AND THE ECON. 1-49 (Adam B. Jaffe et al. eds., 2002); Christopher Pleatsikas & David Teece, *The Analysis of Market Definition and Market Power in the Context of Rapid Innovation*, 19 INT. J. IND. ORG. 665–93 (2001).

18. *See, e.g.,* Konstantinos Stylianou, *Systemic Efficiencies in Competition Law: Evidence from the ICT Industry*, 12 J. COMPET. LAW ECON. 557 (2016).

19. *See, e.g.,* Evans & Schmalensee, *supra* note 17; Michael Whinston, *Exclusivity and Tying in U.S. v. Microsoft: What We Know, and Don't Know*, 15 J. ECON. PERSPECT. 63 (2001).

20. *See, e.g.*, Schmalensee, *supra* note 8; Michael L. Katz & Carl Shapiro, *Antitrust in Software Markets*, *in* COMPETITION, INNOVATION AND THE MICROSOFT MONOPOLY: ANTITRUST IN THE DIGITAL MARKETPLACE 29 (Jeffery A. Eisenach & Thomas M. Lenard eds., 1999).

21. *See, e.g.*, JEAN-JACQUES LAFFONT & JEAN TIROLE, COMPETITION IN TELECOMMUNICATIONS (MUNICH LECTURES) (2001).

actors what kind of competition they can and cannot engage in. Further, they map onto the existing analytical framework of exclusion, and as such they respond to Easterbrook's call for reliance on existing general-purpose tools, but are examined here under the technology prism, thereby also responding to Lessig's call for consideration of the digital exceptionalism.

Recasting the framework of exclusion in digital markets is necessary not simply for the sake of organizing and codifying the additional considerations suggested herein as a matter of theory, but chiefly to set exclusion on the right dimensions as a matter of practice. Exclusionary practices have a long and troubled history in regulatory and antitrust circles. They have traditionally been regarded with suspicion, and it was not until the rise of the Chicago School that courts and authorities—having been convinced by the economic analysis of modern industrial organization—began to tolerate exclusion.[22] But even if, as a general matter, exclusionary practices today are considered a priori neutral and are governed by the rule of reason, exclusion in digital markets arguably still carries a stigma. Digital markets are often associated with claims for openness, sharing, and non-discrimination, all of which are in tension with exclusion. The recent aggressive net neutrality rules[23] and the close scrutiny of data interconnection agreements in the Open Internet Order,[24] the recurrent antitrust investigations against tying and integration (e.g., the Microsoft and Google cases),[25] and the highly precautionary concessions in merger approvals (e.g., the SBC/Ameritech merger)[26] are

22. Richard Schmalensee, *Thoughts on the Chicago Legacy in U.S. Antitrust*, *in* HOW THE CHICAGO SCHOOL OVERSHOT THE MARK: THE EFFECT OF CONSERVATIVE ECONOMIC ANALYSIS ON U.S. ANTITRUST 11 (Robert Pitofsky ed., 2008).

23. As explained briefly *infra* footnotes 94-95 and accompanying text, the adopted rules in the US and the EU were stricter than other alternatives that were considered but rejected. *Compare* In the Matter of Protecting and Promoting the Open Internet, GN Docket No. 14–28 (2015) (Report and Order on Remand, Declaratory Ruling, and Order), ¶¶ 14-18 (hereinafter Open Internet Order) *and* In the Matter of Protecting and Promoting the Open Internet, GN Docket No. 14-28 (2014) (Notice of Proposed Rulemaking), ¶¶ 116-136 (hereinafter Open Internet NPRM). *See also* Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and amending Directive 2002/22/EC, art. 3 (hereinafter Open Internet Regulation).

24. For the first time, the Open Internet Order gives the FCC the power to supervise data interconnection agreements on the Internet. *See* Open Internet Order, *supra* note 23, at 194-206.

25. European Commission Press Release IP/15/4780, Antitrust: Commission sends Statement of Objections to Google on comparison shopping service; opens separate formal investigation on Android (Apr. 15, 2015).

26. To alleviate foreclosure concerns the concessions included the obligation to create a separate affiliate for advanced services (i.e. broadband Internet), and access to loop information. *See* SBC Communications Inc./Ameritech, Memorandum Opinion and Order, 14 FCC Rcd. 14712, App. C – Conditions, paras 1 et seq., 19 et seq. (1999).

all examples of policies that show a fundamental fear of exclusion. Even the public at large seems to be suspicious of exclusionary practices.[27]

It is not the purpose of this Article to conclude definitively on whether this fear is justified in each particular case; but the collective reading of the considerations presented herein does cast a certain measure of doubt. The overall impression from factoring in the technology-intensive nature of digital markets is that exclusionary practices are less likely than assumed to be harmful to the institutional process of competition. This is not to say that the technological aspects of digital markets do not at the same time create new opportunities for anticompetitive exclusion (e.g. technical integration can be a more efficient tying mechanism than those available in physical commodities markets). But the reconceptualization of digital exclusion attempted here suggests that, while technology may create new *methods* of exclusion in digital markets, its main and lasting effect is that it fundamentally changes the *nature* of competition as a generalized condition in the market.

The remainder of this Article proceeds as follows: a short introduction to exclusion is offered in Part 2 for the purposes of laying down basic assumptions, an analytical framework, and the overall ideological tone of the article. Then Parts 3 to 6 discuss the relevant parameters in assessing when digital exclusion can be anticompetitive. In particular, Parts 3 and 4 look into the competitive conditions in the market and discuss mechanisms by which the supply and demand sides of markets react to exclusionary practices to limit them. Part 5 concerns itself with another condition of anticompetitive exclusion, namely the requirement that the power to exclude and the related exclusionary practice persist in time to a degree that regulatory or antitrust intervention becomes necessary. Part 6 illuminates the exclusion's role as a business strategy in digital markets. The idea is that under the special conditions of digital markets, some exclusionary practices may con-

27. A study that analyzed almost a million comments submitted at the 2014 Open Internet proceedings, concluded that 99% of the comments were in favor of network neutrality. *See* PRESS RELEASE, SUNLIGHT FOUNDATION, WHAT CAN WE LEARN FROM 800,000 PUBLIC COMMENTS ON THE FCC'S NET NEUTRALITY PLAN? (Sept. 2, 2014), available at http://sunlightfoundation.com/blog/2014/09/02/what-can-we-learn-from-800000-public-comments-on-the-fccs-net-neutrality-plan/. A similar study showed that 81% of survey participants opposes discriminatory treatment on the Internet, and another one that "public opinion was overwhelmingly pro net neutrality." *See also* PRESS RELEASE, UNIVERSITY OF DELAWARE CENTER FOR POLITICAL COMMUNICATION, NATIONAL SURVEY SHOWS PUBLIC OVERWHELMINGLY OPPOSES INTERNET "FAST LANES" (Nov. 10, 2014), available at http://www.udel.edu/cpc/research/fall2014/UD-CPC-NatAgenda2014PR_2014NetNeutrality.pdf; KNIGHT FOUNDATION, DECODING THE NET NEUTRALITY DEBATE: AN ANALYSIS OF MEDIA, PUBLIC COMMENT AND ADVOCACY ON OPEN INTERNET, available at http://www.knightfoundation.org/features/netneutrality, In another example, when the T-Mobile/AT&T merger was announced, the two companies faced a significant backlash from the public fearing that the resulting company would create exclusionary pressures in the wireless market. For a summary see Wikipedia, Attempted Purchase of T-Mobile USA by AT&T, *available at* http://en.wikipedia.org/wiki/Attempted_purchase_of_T-Mobile_USA_by_AT%26T#Reception.

stitute normal competition and not monopolization techniques, which would remove them from the range of offenses regulators or antitrust authorities would wish to pursue. Taken together these factors update and enrich the general analytical framework used to assess exclusion.

I. Exclusion: What We Know

A. *Definition and Taxonomy*

Exclusion is a broad term that is used to describe a variety of business practices and effects. Economists Rey and Tirole define exclusion as "a dominant firm's denial of proper access to an essential good it produces, with the intent of extending monopoly power from that segment of the market (the bottleneck segment) to an adjacent segment (the potentially competitive segment)."[28] From the definition it should be obvious that not every "denial of proper access" is exclusionary—an important observation considering that competitors sometimes have the propensity to blame dominant firms for their inability to compete successfully in the market. But the exact conditions that need to be fulfilled are a point of contention.

The above definition provides some guidance, but perhaps because it has its source in economics, it is not fully suited to the needs of antitrust courts or regulatory authorities. For example, the element of intent is not normally required,[29] and extension of market power to a neighboring market is not the only outcome excluding firms may hope for—preventing entry or maintaining existing market power in a market can well be alternative goals (and potentially problematic from a policy perspective).[30] Legal definitions, however, are not any more precise; they still define exclusion by recourse to the *practices* by which it is performed, and the *effects* it causes. For instance, Hovenkamp defines exclusionary conduct as that which consists of acts that "are reasonably capable of creating, enlarging or prolonging monopoly power by impairing the opportunities of rivals, and that either (a) do not benefit consumers at all; (b) are unnecessary for the particular consumer benefits that the acts produce; or (c) produce harms disproportionate to the resulting benefits."[31] I am not critiquing the lack of a universally accepted definition here; I am merely noting the ambiguity, which creates the need for

28. Patrick Rey & Jean Tirole, *A Primer on Foreclosure*, in Handbook of Industrial Organization 2145, 2145 (Mark Armstrong & Robert Porter eds., 2007).

29. Intent is usually only relevant in cases of attempted monopolization or used by courts and authorities to better understand the exclusionary conduct but not as a constituent element of the conduct itself. *See* Herbert Hovenkamp, Federal Antitrust Policy: The Law of Competition and Its Practice 302–03 (4th ed. 2011).

30. *See infra* notes 42-44 and accompanying text.

31. Hovenkamp, *supra* note 29, at 298-301. *See also* Lawrence Sullivan, Warren Grimes & Christopher Sagers, The Law of Antitrust: An Integrated Handbook 111 et seq. (3rd ed. 2016).

some elaboration on the most common exclusionary practices and their effects.

The manifestations of exclusionary practices can be diverse.[32] What they all have in common is that they make it harder or impossible for a competitor to gain access to necessary inputs or distribution channels along the value chain. Exclusion does not have to be complete, namely to result in full refusal of access to an upstream or downstream input; it can also consist in manipulating the conditions of access to an input to make access less profitable or otherwise less advantageous for one actor relative to another (presumably an affiliate of the excluding firm).[33] Sometimes this is referred to as discrimination.

Exclusion is commonly implemented through the following forms:[34]

> *Vertical integration:* A firm can integrate into two or more production stages. If one of the production stages controlled by the integrated firm is a bottleneck (the effect of dominance), the firm can harm its competitors in other production stages by blocking access to the bottleneck market.[35] To a very large extent, the chronicle of the liberalization of the telecommunications market, for example, is dominated by cases of such type of foreclosure. In 1913 the Justice Department filed an antitrust suit against AT&T asking it to open up its long-distance network to local exchange providers for fear that, without access to long-distance service, these providers stood no chance to compete against local AT&T service.[36] In 1968 a private complaint forced AT&T to open its network to "foreign attachments" thereby paving the way to the emergence of the equipment industry.[37] AT&T's breakup in 1984 was also animated by the concern that local exchange providers would not be able to compete against AT&T's local service if AT&T's integrated long distance network continued to be a near-monopoly.[38] In all these cases access

32. HOVENKAMP, *supra* note 29, at 313–14. Thomas Krattenmaker & Steven Salop, *Anticompetitive Exclusion: Raising Rivals' Costs to Achieve Power over Price*, 96 YALE L. J. 209, 215–19 (1986) (who treat "disparate doctrines" such as tie-ins, exclusive dealings, long-term contracts, refusal to deal, as a single phenomenon, namely vertical exclusion).

33. Rey & Tirole, *supra* note 28, at 2149–50.

34. *Id.* at 2148–50; *See also* JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION 193 (4th ed. 1990).

35. DENNIS W CARLTON & JEFFREY M PERLOFF, MODERN INDUSTRIAL ORGANIZATION 388–90 (1990). In other words, vertical integration and tying are only a concern when the challenged firm has market power (and therefore serves as a bottleneck).

36. U.S. Dep't of Justice, Kingsbury Commitment, (Dec. 1913) (referring to the consent decree between the United States and AT&T in 1913).

37. Carter v. AT&T, 13 F.C.C. 2d 420 (1968). *See also* Hush-A-Phone v. United States, 238 F.2d 266 (D.C. Cir. 1956); United States v. Western Elec. Co., Civil Action 17-49 (D.N.J. 1956).

38. United States v. AT&T, 552 F.Supp. 131 (D.D.C. 1982).

to a segment of the network was deemed both essential for the survival of competitors, and blocked by the integrated actor.

Tying: Short of integration, a firm can tie the bottleneck product to the competitive product with the intent to strengthen the competitive product's position in the market to the detriment of other products in that market. If the tying is not exclusive, its effect is that it may make competition for rivals harder, but if it is exclusive then rivals are de facto foreclosed as they lose access to the essential bottleneck market.[39] For instance, Microsoft tied Internet Explorer to its Windows operating system making it harder for alternative internet browsers to compete, eventually forcing some of them (most notably Netscape) to extinction.[40]

Refusal to deal (or dealing on discriminatory terms): A firm controlling a bottleneck part of the value chain can refuse to deal with firms upstream or downstream, with the intent to promote a competing affiliate.[41] Refusal to deal can be performed by refusing to transact with an actor or by employing technological means to block the interoperation of components, for example by making them incompatible.[42] For example, Skype and Google Voice were initially blocked on iPhone. The two firms alleged that AT&T saw them as potential competition to its own native voice service and agreed with Apple (for whom AT&T was the exclusive partner carrier) to have them blocked.

While exclusionary practices differ in terms of implementation, they are all associated with common antitrust concerns, which are the motivating force for scrutiny by courts and authorities. Exclusion can result in either a complete inability of competitors to access an essential neighboring market, product, or service, or in the creation of obstacles that place competitors at an unfairly disadvantageous position. Under these circumstances, the excluding firm can expand its power to other segments of the market, while its competitors may be squeezed to only a segment of the market, or be forced to either exit the market or to turn to an inferior or costlier alternative.[43]

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39. CARLTON & PERLOFF, *supra* note 34, at 371.

40. *See* Nicholas Economides, *The Incentive for Non-price Discrimination by an Input Monopolist*, 16 INT'L J. OF INDUS. ORG. 271, 272–3 (1998); Whinston, *supra* note 19.

41. SULLIVAN, GRIMES, & SAGERS, *supra* note 31, at 122–25.

42. Economides, *supra* note 40, at 272; Janusz Ordever, *An Economic Definition of Predation: Pricing and Product Innovation*, 90 YALE L. J. 8 (1981).

43. Guidelines on the Assessment of Non-horizontal Mergers Under the Council Regulation on the Control of Concentrations Between Undertakings, 2008 O.J. (C 265) 7, ¶ 29-30 (EC). *See* HERBERT J. HOVENKAMP & PHILLIP E. AREEDA, *Antitrust Law: An Analysis of Antitrust Principles and Their Application*, para. 756b7 (3d ed. 2006); KIP W. VISCUSI, JOSEPH E. HARRINGTON & JOHN M. VERNON, ECONOMICS OF REGULATION AND ANTITRUST 248–53 (4th ed. 2005).

Exclusion can also result in the creation of entry barriers in the market the excluding firm wants to protect, thereby barring potential competitors from expanding themselves. If the protected market is essential (e.g. to reach consumers or to meet minimum efficient scale), entry barriers can result in competitors even exiting neighboring markets.[44]

To illustrate, consider the following examples: a situation where the downstream market consists of five firms, with firm A_1 having 50% of the market and the other four firms combined having the remaining 50%. The upstream market consists also of five firms, but A_1 decides to block one of them, firm B_1. Now B_1 is in a disadvantageous position because it lost a major distribution channel to consumers.[45] This situation was prominently discussed in the merger between Time Warner and Turner Broadcasting.[46] Time Warner controlled more than 40% of the programming market, whereas Turner and its affiliates controlled about a 30% share in cable distribution, which would rise to about 45% after the merger. The fear was that after the merger the Time Warner conglomerate might refuse to carry programming by alternative producers thereby barring them from a large share of the market.

Moreover, if the new scale of operations allowed by the residual demand is insufficient to support B_1, B_1 may be forced to exit the market.[47] This happened to Netscape internet browser. The Windows operating system was the bottleneck product and Internet Explorer was the competitive product, which attempted to take on the popular Netscape Navigator. Microsoft, through tying, exclusive dealing contracts, zero-rate pricing, and other tactics, asphyxiated Netscape's revenue streams, eventually squeezing it out of the market.[48]

Consider also a related hypothetical, whereby B_1 provides a technologically advanced input that both A_1 and its competitor, A_2, use. A_1 decides to integrate (or a tactic of equivalent effect) with B_1 and to block access of A_2 to B_1. Instead, A_2 can only use the technologically inferior or costlier B_2 input. With this policy A_1 manages to raise A_2's costs of production and make it less competitive. A similar effect would arise if A_1, instead of blocking B_1, sells it to A_2 at a higher price (a price squeeze through price discrimination).[49] Again, A_2 incurs a higher cost of production compared to A_1.

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44. *See* SULLIVAN, GRIMES, & SAGERS, *supra* note 31, at 102–04.

45. *See Id.* at 116.

46. Time Warner, Inc. et al., Proposed Consent Agreement with Analysis to Aid Public Comment, 61 Fed. Reg. 50301 (F.T.C. 1996) (where "Time Warner, Turner, TCI and its subsidiary Liberty Media Corp. have agreed to make a number of structural changes and to abide by certain restrictions designed to break down the entry barriers created by the proposed transaction.").

47. *See generally* Economides, *supra* note 40, *passim*.

48. Richard J Gilbert & Michael L Katz, *An Economist's Guide to U.S. v. Microsoft*, 15 J. ECON. PERSP. 25 (2001).

49. TIROLE, *supra* note 34, at 194.

As mentioned, in a more dynamic view of the market, exclusionary conduct can also prevent entry.[50] If potential entrants fear that they may be prevented from using the bottleneck product or use it under discriminatory terms, they may find it difficult to compete and therefore opt not to enter.[51] The motivation for the exclusionary actor is to protect itself from competition both in the (potentially) competitive market and in the bottleneck market: in the competitive market, because, without access to the bottleneck product, potential entrants may be discouraged.[52] A possible solution to this problem would be to enter both the upstream and downstream levels of the value chain so that a new entrant can exercise full control over its production and distribution lines. But this solution can come with a considerable extra cost, both in terms of the required time for a potential entrant to prepare, and in terms of capital expenditures.[53]

Exclusion may also be sensible as a competitive strategy to protect the bottleneck market, because preventing entry in the competitive segment may hinder entrants from gaining the necessary foothold to subsequently expand in the bottleneck market as well. This is more relevant in situations where the bottleneck market requires significant investments and potential entrants would rather take a gradual approach. A good example here is the *"ladder of investment"* theory on which much of the European telecommunications infrastructure liberalization was based.[54] The ladder of investment theory expressed the idea that, because the telecommunications market is capital-intensive, entrants will only be able to expand gradually to the various layers of telecommunications services. However, this would not be possible if they could not initially gain access to the existing infrastructure of the incumbents. For this reason, the European Commission mandated that incumbents offer open access to their networks under certain conditions that were aimed to strike a fair balance between incumbents' and entrants' interests.

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50. *See* VISCUSI, HARRINGTON, & VERNON, *supra* note 43, at 168–72.

51. Carlton & Waldman, *supra* note 8.

52. *See* TIROLE, *supra* note 34, at 51.

53. *See* Jonathan Baker, *Recent Developments in Economics that Challenge the Chicago School Views*, 58 ANTITRUST LAW J. 645, 651 et seq. (1989); RICHARD POSNER, ANTITRUST LAW 202 (2nd ed. 2009) ("the possibility that tying might discourage entry into the monopolized market for the tying product cannot be excluded altogether."); HOVENKAMP & AREEDA, *supra* note 43, at ¶756(c)(3); *see also* Town of Concord Massachusetts v. Boston Edison Company, 915 F.2d 17, 23 (1st Cir. 1990) ("Insofar as it is more difficult for a firm to enter an industry at two levels than at one, the monopolist, by expanding its monopoly power, has made entry by new firms more difficult.").

54. Martin Cave, *Encouraging Infrastructure Competition via the Ladder of Investment*, 30 TELECOMM. POLICY 223 (2006); s*ee also* DR. KARL-HEINZ NEUMANN ET AL., WIK-CONSULT, STUDY ON THE IMPLEMENTATION OF THE EXISTING BROADBAND GUIDELINES (FINAL REPORT TO THE EUROPEAN COMMISSION, COMP/2011/006), at 163-65.

B. *Assessing Exclusion's Threat to the Competitive Process*

As mentioned, it is not contested here that the general framework available to courts and regulators to assess the anticompetitive threat of exclusionary practices is adequate. It has been in development for decades and is the result of the fruitful exchange between economists and legal scholars. Rather, the problem was identified to be that the different parts of the framework do not reflect the role of technology, which, naturally, is decisive in technology-intensive industries.[55] This overlook risks yielding misleading results on the necessity and intensity of ex ante regulatory action or ex post antitrust enforcement.

This part provides a brief presentation of the existing framework. The goal is to highlight the general parts of the framework onto which the additional technological considerations offered in this Article will be mapped. Keeping the existing framework in place helps situate the contribution of this Article in familiar territory.

1. The Modern Context of Anticompetitiveness

As a general matter, the question of which behavior is anticompetitive is existential in antitrust law and regulation and almost impossible to answer definitively.[56] Potentially anticompetitive exclusionary conduct is no exception. That said, some basic tenets of the modern context of anticompetitive exclusionary conduct should be noted here, as they serve as the underlying principles of the framework in use. Without claiming that these principles are universally accepted,[57] they have and continue to enjoy wide adoption, and for the purposes of this Article, I do not take issue with them.

For the most part, the philosophical core of exclusion was shaped by the intellectual *bras-de-fer* between the Harvard school and the Chicago school of industrial organization and antitrust.[58] The Chicago school is thought to

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55. *See* Introduction.

56. *See generally*, Eleanor Fox, *What is Harm to Competition? Exclusionary Practices and Anticompetitive Effect*, 70 ANTITRUST LAW J. 371 (2002).

57. The principles discussed here emanate from or were crystalized by the Chicago school. That school of thought, however, was accused of showing excessive confidence in the operation of markets, of failing to account for market realities, such as lack of perfect information and switching costs, and of overstating efficiencies. Therefore, its assumptions and basic principles are not universally accepted. *See* HOVENKAMP, *supra* note 29, at 73–77. Richard R. Nelson, *Comments on a Paper by Posner*, 127 U. PA. L. REV. 949 (1979); F. M. Scherer, *The Posnerian Harvest: Separating Wheat from Chaff (Reviewing Antitrust Law: An Economic Perspective by Richard Posner)*, 86 YALE L. J. 974 (1977); Herbert J Hovenkamp, *The Reckoning of Post-Chicago Antitrust*, *in* POST-CHICAGO DEVELOPMENTS IN ANTITRUST LAW 1, 3 (Antonio Cucinotta, Roberto Pardolesi, & Roger Van den Bergh eds., 2002) ("The Chicago School contribution to antitrust did two things. First, it gave us much that was useful. Second, it was oversold.").

58. For their diverging approaches *compare* United States v. Arnold, Schwinn & Co., 388 U.S. 365 (1967); ARTHUR BURNS, THE DECLINE OF COMPETITION: A STUDY OF THE EVOLUTION OF AMERICAN INDUSTRY (1936); JOE S. BAIN, BARRIERS TO NEW COMPETITION

have emerged as the winner,[59] with its basic assumptions becoming the foundations for exclusionary analysis.

Perhaps the most basic insight of the Chicago style analysis on exclusionary conduct is that it is not uniformly good or bad for the industry,[60] the general tendency being to condone rather than condemn it.[61] It is true that strategic exclusionary behavior can restrict competition, but it is also true that numerous efficiency-generating practices involve exclusionary measures (e.g. exclusive dealing to prevent free riding).[62] Therefore, it cannot be said in the abstract that exclusionary conduct is acceptable or not; rather, a review of the particular circumstances of the conduct and the industry is necessary.[63]

Further, not all negative effects of exclusionary behavior should trigger liability. It is now long established that aggressive but fair/legitimate competition, even if it results in foreclosure of competitors, is not only expected but also welcome. As Judge Easterbrook has stated "injuries to rivals are byproducts of vigorous competition" and therefore "to deter aggressive conduct is to deter competition."[64] In the same vein, the Court of Justice of the European Union (CJEU) emphasized in *Post Danmark* that "competition on the merits may, by definition, lead to the departure from the market or the marginalization of competitors that are less efficient and so less attractive to consumers from the point of view of, among other things, price, choice, quality or innovation."[65] This is to say that the showing of negative (perhaps even destructive) consequences to rivals does not make exclusion automati-

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(1956); CARL KAYSEN & DONALD F. TURNER, ANTITRUST POLICY: AN ECONOMIC AND LEGAL ANALYSIS (1959); *with* Continental T.V., Inc. v. GTE Sylvania, Inc., 433 U.S. 36 (1977); United States v. Brown University, 5 F.3d 658, 668 (3rd Cir. 1993) ("The rule of reason requires the fact-finder to weigh all of the circumstances of a case in deciding whether a restrictive practice should be prohibited as imposing an unreasonable restraint on competition. The plaintiff bears an initial burden under the rule of reason of showing that the alleged combination or agreement produced adverse, anti-competitive effects within the relevant product and geographic markets."); Herbert J Hovenkamp, *Post-Chicago Antitrust*, 2001 COLUMBIA BUS. REV. 257 (2001); Herbert J Hovenkamp, *Antitrust Policy After Chicago*, 84 MICH. LAW REV. 213 (1985).

59. *But see* Einer Elhauge, *Harvard, Not Chicago: Which Antitrust School Drives Recent U.S. Supreme Court Decisions?*, 3 COMPET. POL'Y INT. 58 (2007).

60. Tirole, as early as 1988, stated that "few topics in industrial organization are as controversial as market foreclosure." TIROLE, *supra* note 34, at 193.

61. James C. Cooper et al., *Vertical Antitrust Policy as a Problem of Inference*, 23 INT. J. IND. ORG. 639 (2005).

62. United States v. Colgate & Co., 250 U.S. 300, 307 (1919); Guidance on the Commission's Enforcement Priorities in Applying Article 82 of the Treaty to Abusive Exclusionary Conduct by Dominant Undertakings, para 75; Case T-201-04 Microsoft v. Commission [2007] ECR II-3601, ¶¶ 319, 330-36.

63. SULLIVAN ET AL., *supra* note 31, at 111–12.

64. Ball Mem'l Hosp., Inc. v. Mut. Hosp. Ins., Inc., 784 F.2d 1325, 1338 (7th Cir. 1986).

65. Case C-209/10 Post Danmark A/S v Konkurrencerådet, 2012 EU:C:2012:172.

cally anticompetitive. Anticompetitive conduct is conduct that "*unnecessarily* excludes or handicaps competitors,"[66] meaning that it impairs competition (not simply individual competitors) without benefiting consumers or promoting progress and innovation.[67]

It should also be noted that exclusionary practices are an expression of firms' freedom to choose their partners as they sit fit.[68] This freedom is clearly limited, but it does underscore what the starting point and the norm is: firms are free to decide the terms and conditions of dealing with competitors (or market players in general) as long as this is not the result of abuse of dominance, monopolization or attempt to monopolize, and it does not threaten the competitive process. As the Court noted in *Verizon*, courts "have been very cautious in recognizing [. . .] exceptions [to the freedom to deal], because of the uncertain virtue of forced sharing and the difficulty of identifying and remedying anticompetitive conduct by a single firm."[69]

2. The Elements of Anticompetitive Exclusion

The above-mentioned principles suggest a need for a framework to parse out exclusion that forms part of regular economic life from exclusion that unfairly disadvantages competition (the meaning of unfairly is itself up for courts and regulators to decide). While not a straightforward exercise, there is now a long line of scholarship and practice that has managed to distill, with some deviations, the essential elements of anticompetitive exclusion. These are the ability and power to exclude, the abuse/exploitation of that power (i.e. the "bad conduct"), and the resulting competitive harm.[70] These factors are predominantly associated with antitrust, but they are also

66. Aspen Skiing Co. v. Aspen Highlands Skiing Corp., 472 U.S. 585, 597 (1985).

67. *See, e.g.,* Advanced Health-Care Services v. Radford Community Hospital, 910 F.2d 139, 148 (4th Cir. 1990). This does not mean that business conduct that falls short of this threshold cannot produce a certain measure of anticompetitive effects. However, due to the limitations of antitrust enforcement, including resources, time it takes to reach a verdict, type and effectiveness of remedies, and due to the general deference to the efficiency of the market and the (often under-appreciated) innovation externalities of business practices, antitrust law by and large pursues only behavior that goes beyond the inconveniencing of individual competitors, affects a significant line of commerce, and is not just a temporary spike in competitive pressure in the market.

68. United States v. Colgate & Co., 250 U.S. 300, 307 (1919); Guidance on the Commission's Enforcement Priorities in Applying Article 82 of the Treaty to Abusive Exclusionary Conduct by Dominant Undertakings, para 75; Case T-201-04 Microsoft v. Commission [2007] ECR II-3601, ¶¶ 319, 330-336.

69. Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398, 408 (2004).

70. *See* Grason Elec. Co v. Sacramento Mun. Util. Dist., 571 F. Supp. 1504, 1512. *See also* HOVENKAMP, *supra* note 29, at 295–301; SULLIVAN, GRIMES, & SAGERS, *supra* note 31, at 111–118. *Cf. also* U.S. Department of Justice & Federal Trade Commission, Horizontal Merger Guidelines, ¶ 4.1.2 (2010).

relevant to regulation.[71] Because the doctrine of exclusion did not develop overnight or derive from a single source, the framework is not as structured as one would expect. Some commentators, for example, factor in efficiencies in the assessment of the element of abuse, while others consider it a separate parameter;[72] or for certain practices the showing of competitive harm may not always be necessary (e.g. exclusive long-term dealing without obvious justifications), although these cases are now rare exceptions. But by and large, the elements identified above are essential in all models.

As a general matter, the first factor determines the potential for anticompetitive exclusionary conduct in the market. It is not enough that one or more competitors or complements will be foreclosed from the market; what matters is whether enough competitors or complements will be foreclosed that the institutional process of competition will be impaired.[73] This is a direct outgrowth of the fact that the goal of antitrust and sectoral regulation is the safeguarding of effective competition in the market, not the protection of individual competitors, and of the principle that firms are free to choose their partners and strategy in the market, which will necessarily result in some exclusion.[74]

The ability to engage in exclusionary practices that can affect competitive conditions is a confluence of both supply and demand considerations. On the supply side, if enough rivals remain in the market or can exert com-

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71. For example, the FCC in the Open Internet Order takes into account broadband providers' ability to foreclose competing services, the lack of legitimate reasons to do so, and the harmful effects on the health of the Internet ecosystem. *See* Open Internet Order, *supra* note 23 ¶¶ 78-103. *See also* Christopher Yoo, *What Can Antitrust Contribute to the Net Neutrality Debate*, 1 INT. J. COMMUN. 493 (2007); Philip Weiser, *Towards a Next Generation Regulatory Strategy*, 35 LOYOLA UNIV. CHICAGO LAW J. 41 (2003). Damien Geradin & J Gregory Sidak, *European and American Approaches to Antitrust Remedies and the Institutional Design of Regulation in Telecommunications*, Handbook of Telecommunications Economics: Technology Evolution and the Internet: Volume 2 517 (Sumit Majumdar, Ingo Vogelsang, & Martin Cave eds., 2005) (concluding that that the prophylactic approach of regulatory authorities considers "the probability of anticompetitive behavior in the absence of the prior restraint. . . the magnitude of the harm from such behavior. . . the likelihood and magnitude of offsetting efficiency justifications. . . and the danger of false positives," and that "there are interactions between antitrust and sector-specific regulations and these have to be taken into account when addressing the issue of remedies."

72. *See, e.g.*, SULLIVAN, GRIMES, & SAGERS, *supra* note 31 at 114.

73. Brown Shoe Co v. United States, 370 U.S. 294, 344 (1962) ("[i]t is competition, not competitors, which the Act protects."). *See also* Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc., 429 U.S. 477 (1977). The European Commission has also explicitly stated that "what really matters is protecting an effective competitive process and not simply protecting competitors" and that "the aim of the Commission's activity in relation to exclusionary conduct is to ensure that dominant undertakings do not impair effective competition by foreclosing their competitors in an anti-competitive way, thus having an adverse impact on consumer welfare." Communication from the Commission – Guidance on the Commission's Enforcement Priorities in Applying Art. 82 of the EC Treaty to Abusive Exclusionary Conduct by Dominant Undertakings, ¶¶ 6, 19 (2009/C 45/02).

74. SULLIVAN, GRIMES, & SAGERS, *supra* note 31, at 10-19.

petitive pressure, e.g. by threat of entry, expansion of output or by other means, then exclusion is less likely to impair the process of competition.[75] Similarly, the easier it is for demand-side actors to access rival products and services the less effective the exclusionary conduct is and therefore the less harmful.[76]

Moreover, it is not enough that the demand and supply conditions conducive to hindering competition occur only momentarily in the industry's lifetime. Transient market power that allows a firm to temporarily exclude its rivals is usually not capable of causing harm to competition (perhaps only to individual competitors). Whatever the effects of exclusion, judicial or regulatory response is not normally warranted unless the practice and effects of exclusion have persisted or can persist in time.[77] This is good practice because both judicial and regulatory measures have a (quasi-)permanent effect and come with a cost, and therefore they are likely to be an appropriate and proportionate response only when exclusion's effect is also expected to be a lasting one.[78] This is particularly important in digital markets because of the frequently cited dynamic nature of the industry (an assumption that we test in this Article).[79]

Moving on, it is also important to establish that the exclusionary effect is the result of abuse of market power, rather than legitimate exercise of it. It is well established that the possession and exercise of market power is not punishable in itself; only the abuse thereof.[80] Most recently the Court in *Verizon* noted that "the mere possession of monopoly power, and the concomitant charging of monopoly prices, is not only not unlawful; it is an

75. *See, e.g.,* Anti-Monopoly, Inc. v. Hasbro, Inc., 958 F. Supp. 895, 904 (1997) ("Unrebutted evidence that actual competitors have entered the market is a strong indicator that [the defendant] lacks market power."); R. J. Reynolds Tobacco Co. v. Philip Morris, 199 F. Supp. 2D 362, 383 ("[a] mere showing of substantial or even dominant market share alone cannot establish market power sufficient to carry out [an anticompetitive pricing] scheme. The plaintiff must show that new rivals are barred from entering the market and show that existing competitors lack the capacity to expand their output to challenge the [defendant's] high price."); Tampa Electric Co. v. Nashville Coal Co., 365 U.S. 320 (1961); Jefferson Parish Hosp. Dist. No. 2 et al. v. Hyde 466 U.S. 2 (1984). *See contra* the heavily criticized case *Brown Shoe*, *supra* note 73. *See also* Guidance on the Commission's Enforcement Priorities in Applying Art. 82, *supra* note 68, ¶ 30, where the European Commission stresses that "where there is no residual competition and no foreseeable threat of entry, the protection of rivalry and the competitive process outweighs possible efficiency gains."

76. Carlton and Perloff, *supra* note 35 at 612. Katerina Maniadaki, EU Competition Law, Regulation and the Internet: The Case of Net Neutrality 168–81 (2014).

77. *See* Lorain Journal Co. v. United States, 342 U.S. 143 (1951) (where the Court was convinced of Lorain Journal's monopoly position not only because of its high market share but also because it had persisted for more than 15 years at the time the case made it to trial).

78. *See infra* Part 5.

79. *See infra* Parts 5.1 and 5.2.

80. Standard Oil Co. of N.J. v. United States, 31 S.Ct. 502, 516 (1911); United States v. Grinnell Corp., 86 S.Ct. 1698, 1704 (1966).

important element of the free market system."[81] This should not be read to mean that dominant firms are completely unrestrained to conduct themselves as they wish, but that tolerating power and the legitimate exercise thereof is an integral part of market organization.[82] Therefore, to the extent that there are legitimate justifications for exclusionary behavior even of dominant firms, the case for antitrust or regulatory action is weakened.

Anticompetitive effect should also be demonstrated.[83] Antitrust practice has moved away from the per se treatment of exclusion, making the showing of competitive harm essential, and regulatory practice also requires showing of persistent and extensive anticompetitive effects as a condition to enact measures.[84] The showing of effects is a factual matter, which does not concern the conduct itself, but rather the condition in which the conduct leaves consumers and the market. As such, it remains unaffected by technological parameters the way they are understood here, and therefore falls outside the scope of this Article.

Building upon this framework, the analysis that follows will focus on certain aspects that differentiate digital markets from traditional markets, highlighting the special characteristics that inform and affect the appropriate treatment of exclusion. Along those lines, the ability to engage in anticompetitive exclusion comes first, with a discussion on the effects of the technology-intensive nature of digital markets on competition, substitution, and consumer choice (the supply and demand factors). The article then moves on to the issue of market evolution and market power persistence, which holds a more pronounced role in dynamic industries and therefore deserves separate consideration. The question of how to construe the element of "anticompetitiveness" in assessing firm conduct concludes the analysis.

II. Ability to Exclude: Supply Side Considerations

Supply side considerations measure the response of competitors to a certain (potentially anticompetitive) action.[85] The idea is that the exclusionary power of an actor is limited by the response of other market players, and therefore firm conduct is unlikely to be harmful to competition if market actors act to contain it. This is true both for ex ante regulation and for ex post antitrust enforcement, because in both cases the competitive response will have either a dissuasive or suppressive effect or both.

Assume, for instance, a downstream firm excludes an upstream input with the goal to deny it of a distribution channel. This strategy cannot be successful if the downstream firm's rivals are ready to offer a distribution

81. *Verizon*, 540 U.S. at 407.

82. Sullivan, Grimes & Sagers, *supra* note 31, at 81–83.

83. Potential efficiencies that offset the negative effects of exclusionary conduct are usually factored in here to calculate the net effect of the conduct under scrutiny.

84. *See infra* Part 6.

85. Hovenkamp, *supra* note 29, at 121–23.

channel to the input, or if the input provider expands into the downstream market itself.[86] The opposite can also be true where a downstream firm blocks access to a (necessary, superior, or cost-saving) input,[87] but rivals switch to the production of the input, or entrants join the input market, and make it available downstream.[88]

Correctly identifying the sources of competitive pressure firms are subject to is probably the most important parameter in the assessment of exclusion because it in turn determines how likely and extensive the effect of exclusion will be on the market. Authorities and courts have come a long way in identifying sources of competition but a lot is left to be desired.

Initially, direct existing competitors were considered the main source of pressure.[89] Over the years, potential entrants or existing market players who switch production to make up for the exclusionary restrictions were also included.[90] For example, in the landmark *Telex Corp. v. IBM Corp.* case, where the issue was whether IBM monopolized the market for "plug-compatible" peripherals, the circuit court did not just consider competition from producers of plug-compatible peripherals (direct competitors), but also from those of non-compatible peripherals who could switch to producing compatible peripherals, or who could use cheap adaptors to make non-compatible peripherals compatible.[91]

The expansion is welcome as it attempts to more fully capture the competitive constraints firms are subject to. But the way this expansion has been applied in digital markets is incomplete and selective. It is so because, firstly, it underrates entry potentials, particularly from firms that are present in one layer of the value chain and expand vertically into another; secondly, because it overlooks the technological potential for reorganization of the

86. Krattenmaker & Salop, *supra* note 32, at 254.

87. This in turn presupposes that the input supplier has an interest in partnering only with the exclusionary downstream firm, and for this to be profitable for the input supplier that downstream firm must possess a rather large market share. *See* Malcolm B. Coate & Andrew N. Kleit, *Exclusion, Collusion, and Confusion: The Limits of Raising Rivals' Costs*, 8014, (Fed. Trade Comm'n Working Paper No. 179, 1990). *See also* Thomas Krattenmaker & Steven Salop, *Analyzing Anticompetitive Exclusion*, 56 ANTITRUST L. J., 1987 at 71. This problem disappears if the upstream and downstream firms integrate.

88. *See* Coate & Kleit, *supra* note 87.

89. *See, e.g.*, United States v. Aluminum Co. of America, 148 F.2d 416, 425-27 (2d Cir. 1945).

90. Jonathan Baker, *The Antitrust Analysis of Hospital Mergers and the Transformation of the Hospital Industry*, 51 L. CONTEMP. PROBS., Spring 1988 at 93, 101–02 (where the author pinpoints the mid-70s as the time courts started considering potential rather than direct existing competitors too, and provides relevant case-law). *Cf.* U.S. DEP'T OF JUSTICE AND FEDERAL TRADE COMM'N, HORIZONTAL MERGER GUIDELINES 2010, ¶¶ 5.1-.2, 9, https://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf (where it is proposed that the response by competitors should be assessed inter alia based on timeliness, likelihood and sufficiency).

91. Telex Corp. v. Int'l Bus. Machines Corp., 510 F.2d 894, 919 (10th Cir. 1975). *See also* Europemballage Corp. & Cont'l Can Inc. v. Comm'n, 1973 E.C.R. 215, at 225.

value chain; and thirdly, because it underestimates vertical shifts in power balance. All three can lead to an inaccurate assessment of competitive conditions. For too long, competition analysis has focused on horizontal relationships because these are traditionally seen to denote substitutes, whereas vertical relationships are thought to denote complements.[92] But if the essence of competition analysis is to determine the plausibility and/or extent of harm based on market power and abuse thereof, then any force that can counter firms' efforts and ability to exclude their rivals from the market should be accounted for regardless of position in the market.[93] Indeed, as Porter has stated:

> [T]he theory of entry barriers has been limited unnecessarily by confining itself to the movement of firms from zero outputs to positive outputs. It becomes much richer—yet remains determinate—when set forth as a general theory of the mobility of firms among segments of an industry, thus encompassing exit and inter-group shifts as well as entry.[94]

This is particularly important in the context of digital markets: as will be shown below, digital markets are characterized by the facilitation of vertical mobility and entry, the multiplication of sources of competitive pressure in the absence of entry, and the increased potential for relocation of functionality (and therefore substitutability) along the value chain. The combined effect of these features should inform the analysis of anticompetitive exclusion in digital markets, which, however, is not always the case.

For example, it is arguable that the recent Open Internet regulations both in the US and the EU, which enacted general ex ante bans on blocking, throttling, and discrimination for fear that broadband providers would foreclosure competing services from the market, did not sufficiently account for the competitive pressure broadband providers are subject to from actors in other parts of the value chain, including over the top (OTT) service provid-

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92. *See* Robert L. Steiner, *Vertical Competition, Horizontal Competition, and Market Power*, 53 ANTITRUST BULL. 251, 251–53 (2008). *See also* U.S. Dep't of Justice & Federal Trade Comm'n, Non-Horizontal Merger Guidelines ¶ 4.0 (1984), https://www.justice.gov/sites/default/files/atr/legacy/2006/05/18/2614.pdf ("By definition, nonhorizontal mergers involve firms that do not operate in the same market.").

93. Steiner, *supra* note 92; *See also* Ioannis Lianos, *The Vertical/Horizontal Dichotomy in Competition Law: Some Reflections with Regard to Dual Distribution and Private Labels*, *in* PRIVATE LABELS, BRANDS AND COMPETITION POLICY 161 (Ariel Ezrachi & Ulf Bernitz eds., 2009); MICHAEL PORTER, THE COMPETITIVE STRATEGY: TECHNIQUES FOR ANALYZING INDUSTRIES AND COMPETITORS 3–5 (2004); JOHN KENNETH GALBRAITH, AMERICAN CAPITALISM: THE CONCEPT OF COUNTERVAILING POWER (2nd ed. 1993); JOSEPH C. PALAMOUNTAIN, THE POLITICS OF DISTRIBUTION 50–51 (1968).

94. Richard Caves & Michael Porter, *From Entry Barriers to Mobility Barriers: Conjectural Decisions and Contrived Deterrence to New Competition*, 91 Q. J. ECON. 241, 241 (1977).

ers, content providers, alternative IP-based network infrastructure providers, or the ever-expanding list of modalities of Internet access.[95] As a result, the ability and incentives of broadband providers to foreclose competition may have been exaggerated. While a fuller account of the competitive conditions would likely not eliminate the need for regulatory action, it is possible that regulators would opt for milder alternatives. A good example is the general-purpose clause suggested (but eventually rejected) in FCC's NPRM of February 2014, which, instead of a general ban "would prohibit as *commercially unreasonable* those broadband providers' practices that, based on the totality of the circumstances, threaten to harm Internet openness and all that it protects" (emphasis added).[96] An application of the technology-informed framework presented herein would suggest that the NPRM regime is more appropriate.

The Microsoft Internet Explorer cases in the US and the EU are also an example of miscalculation of the competitive conditions in the market. In said cases, Microsoft was required to give consumers the choice of Internet browser, after it was found that Microsoft's Internet Explorer was dominant, and that IE's tying to Windows had the potential to foreclose competition in the browser market.[97] The only path to reaching this conclusion, especially at the time the EU case was handled, was through overestimating entry barriers, through ignoring the direction of the market's evolution and IE's steadily declining market share, through ill-defining substitutability to exclude competition from phone and (the then upcoming) tablet browsers, and through exaggerating the potential harm to operating system competitors and application developers.[98] We can safely see today that none of the relevant concerns ever materialized, and the browser market was highly competitive already around the end of the Microsoft litigation and shortly thereafter, which implies that the antitrust commitments were not instrumental.[99] What

95. Open Internet Order, *supra* note 23, ¶¶ 78-85; *See also* BODY OF EUROPEAN REGULATORS FOR ELECTRONIC COMMUNICATIONS, AN ASSESSMENT OF IP INTERCONNECTION IN THE CONTEXT OF NET NEUTRALITY 9-15 (2012). *See also* Konstantinos Stylianou, *The Persistent Problems of Net Neutrality or Why Are We Still Lacking Stable Net Neutrality Regulation*, in NET NEUTRALITY COMPENDIUM 211, 221–22 (Luca Belli & Primavera De Filippi eds.) (2016).

96. At the same time, it could permit "broadband providers to serve customers and carry traffic on an individually negotiated basis, 'without having to hold themselves out to serve all comers indiscriminately on the same or standardized terms,' so long as such conduct is commercially reasonable." *See* Open Internet Order, *supra* note 23, ¶ 116.

97. New York v. Microsoft Corp., 224 F. Supp.2d 76 (D.D.C. 2002); Case COMP/C-3/39.530 Microsoft, Commission Decision of 16 Dec. 2009, available at http://ec.europa.eu/competition/antitrust/cases/dec_docs/39530/39530_2671_3.pdf.

98. Lopatka & Page, *supra* note 8, at 211–29.

99. *But see* COATES, *supra* note 15, at 267, who concludes that Microsoft's continuing high market share in both the operating system and the Internet browser market is an indication that persistent monopolies even high technology dynamic markets are likely. Coates seems to be focusing on static market shares and not the fact that they were (and still are) steadily declining, but he also seems to assume that the original harms associated with the

is even more interesting, is that four years later the European Commission fined Microsoft for non-compliance to its decision, thusly re-validating the perceived relevance of the original decision in a competitive environment that was even more removed from any conditions that would warrant a finding of potential foreclosure.

Against the backdrop of examples like the above, but also newer cases like the Google Android investigation in the U.S. and the EU, which revolves around the potential exclusion of operating system and application manufacturers, it becomes imperative to ensure that due consideration is given to all factors that feed into the assessment of the anticompetitive threat of exclusion in digital markets. As mentioned, when it comes to the supply side of the ability to exclude, the focus will be on three areas: entry potentials, particularly from firms that are present in one layer of the value chain and expand vertically into another; the technological potential for reorganization of the value chain; and vertical shifts in power balance.

A. *Technological Proximity and Facilitation of Vertical Mobility and Entry*

Entry expresses the situation (or possibility) whereby new firms join the market with the potential effect of undercutting the exclusionary impact.[100] In a way, entry is even more important than existing competition because it is forward-looking and therefore reflects the conditions of the market when the decision of a regulatory or competition authority will materialize. For example, in the acquisition of Skype by Microsoft, recently approved by the FTC and the European Commission, it was noted that while Skype has been, and continues to be, the most popular service of its kind, barriers to entry are low, numerous high quality alternatives have appeared recently and are likely to appear in the future, and switching is easy.[101] This implies that even if the market is dominated by a single player, their dominance is not stable if market conditions are conducive to threat by competitors, existing or potential. In Skype's case, the threat came not only from direct horizontal competitors to Skype on the Windows platform, but also from other platform

acquisition and maintenance of the monopoly position through anticompetitive practices continue to materialize. If this assumption does not hold, then neither the monopoly position nor the associated practices should concern us. And indeed, it is rather doubtful that competition or consumers were harmed by IE's or WMP's tying in the post 2010 era. Netscape and RealPlayer may have been eclipsed, but the market for browsers and media players was and is highly competitive, and therefore, while individual competitors were harmed, the process of competition was not.

100. SULLIVAN, GRIMES, & SAGERS, *supra* note 31, at 69–71.

101. *See Early Termination Notice 20110881: Microsoft Corp. – Skype Global S.a.r.l.*, FTC (June 16, 2011), https://www.ftc.gov/enforcement/premerger-notification-program/early-termination-notices/20110881; Case COMP/M.6281-Microsoft/Skype Regulation (EC) No 1392004 Merger Procedure at 14 et seq. (July 10, 2011), *available at* http://ec.europa.eu/competition/mergers/cases/decisions/m6281_924_2.pdf.

substitutes. As the European Commission noted, "there is an increasing trend of consumers using smartphones and tablets instead of PCs. This development limits the effects of any foreclosure strategy by the parties which provide services predominantly based on Windows PCs."[102]

The value of entry as a factor in the assessment of exclusion lies in its extent, likelihood and credibility, which are closely tied to industry characteristics.[103] If there are factors that make an industry particularly prone to easy, credible entry, then these should be accounted for in the assessment of exclusionary practices. The technology policy literature, which has remained underused in antitrust and regulatory theory and practice, offers valuable insights into how the technology-intensive nature of digital markets facilitates entry and mobility, thereby making the supply side more responsive to exclusionary practices. The enhanced entry and mobility conditions either weaken the effects of exclusion due to another competitor joining the market or act in a dissuasive manner to prevent exclusion from taking place in the first place.

In the classic static view of a value chain, the various layers that make it up are thought to have been assigned *distinct* roles, and the final product or service is the result of the cumulative contributions of all layers. This understanding implies that, although the layers are working together, they are separate and each is confined to its own respective area of activity. For instance, in the mobile communications value chain, software developers contribute applications, hardware manufacturers contribute devices, network providers contribute connectivity, and so on.

However, there is nothing that axiomatically locks firms in a single layer. In fact, it is rather intuitive that, given the opportunity and provided that it makes business sense, a firm will enter adjacent layers. In this context, firms that used to serve as complements to other levels of the value chain can transcend their boundaries and enter into a competing relationship with their once complements.[104] Vertical mobility of this kind adds to the supply side pressure the same way direct horizontal entry would occur to fill in whatever the excluding firm deprived the market of. Evidence of this trend is plentiful as there are numerous examples of digital firms that expanded broadly and rapidly into markets adjacent to those they originated in; for example, all of the big five Internet companies (Amazon, Apple, Facebook, Google, Microsoft) started from one market and have very rapidly expanded

102. Case COMP/M.6281–Microsoft/Skype, *supra* note 101, at 28.

103. For a summary of these conditions *see* Lazaroff, *supra* note 8, at 22–28. For a discussion on the industry-specific characteristics *see* Steven Salop, *Measuring Ease of Entry*, 31 ANTITRUST BULL. 551 (1986).

104. *See* Timothy Bresnahan & Shane Greenstein, *Technological Competition and the Structure of the Computer Industry*, 47 J. IND. ECON. 1, 37–38 (1999).

to approximately 10–15 adjacent markets in a matter of only a few years, an unprecedented occurrence in traditional industries.[105]

Technology-driven industries are particularly prone to the kind of vertical mobility described here, allowing for a greater possibility that exclusionary effects will be contained, if needed. They facilitate and encourage vertical expansion because, as Bresnahan and Greenstein have persuasively argued, the technological interdependence of firms along the value chain (in the sense that the design of one layer is often affected by the design of another layer) and the ability of firms to accumulate technical knowledge from their surroundings enable them to more easily cross over to neighboring layers upstream or downstream:

> Technically, there are no given and exogenous boundaries between the layers. The functions now performed by one platform component might instead be performed by another. Both software and hardware have shown this malleability. The firms supplying key components of the same platform often have broadly similar technical capabilities. Each would be capable of taking over the other's position.[106]

This process is not automatic and there are entry barriers like in any other industry, including the fact that established platforms and technologies can be hard to dislodge because they are linked to significant investments, a well-developed customer base, and often lock-in effects.[107] But in technical industries where specialized knowledge, skills, and know-how are considered core competences, and are relevant in more than one layer, adjacent firms are already well-equipped (or at least better equipped compared to new entrants) to expand.[108] It is harder to find this element in more traditional industries, where every layer is characterized by different attributes. For instance, in the property industry, the construction layer is markedly different from its adjacent real estate services layer, a situation which is less pronounced in digital markets where for example, the operating system layer is not all that removed from the applications layer.

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105. S*ee infra* Table 1 & accompanying notes 117-24.

106. Timothy Bresnahan, *New Modes of Competition*, *in* COMPETITION, INNOVATION AND THE MICROSOFT MONOPOLY: ANTITRUST IN THE DIGITAL MARKETPLACE 155 (Jeffrey Eisenach & Thomas L. Lenard eds., 1999).

107. *See* JOHN SUTTON, SUNK COSTS AND MARKET STRUCTURE 45–83 (2007) (concluding that a platform or technology incurs significant endogenous sunk costs on the basis of irreversibility, specificity, unlimited efficacy, and (near-) unanimity about efficacy). *See also* STANLEY M. BESEN & GARTH SALONER, *Compatibility Standards and the Market for Telecommunications Services*, *in* CHANGING THE RULES: TECHNOLOGICAL CHANGE, INTERNATIONAL COMPETITION, AND REGULATION IN COMMUNICATIONS 194–99 (Robert W. Crandall & Kenneth Flamm eds., 1989).

108. *See* Macher & Mowery, *supra* note 11.

As a result, over time, firms in high technology markets can eventually amass the necessary knowledge and capital, "attain sufficient capabilities to attract a larger network of suppliers and support. . . [and] grow strong enough to move into an old platform's market."[109] Cohen and Levinthal describe a similar process, which they call *absorptive capacity*.[110] The absorptive capacity of firms increases with their familiarity with the new knowledge they acquire from another firm, and so the closer the firms are in terms of prior knowledge and activities the easier it is for them to cooperate or compete.[111]

What makes this type of vertical transcendence even more likely, easy, and effective is that high technology firms oftentimes find vertical expansion *necessary* in order to correctly delineate their technical boundaries. This creates strong incentives for vertical expansion and increases competitive pressure in the market. Traditional industrial organization thinking associates the boundaries of the firm with economic and managerial or organizational considerations. The transaction costs theory places the natural boundaries of the firm around those activities that are cheaper to produce or perform internally than procure from the open market,[112] while managerial and organizational control theories revolve around the idea that the insular nature of the firm enhances internal cohesion, coordination and control, and so activities that are closely linked together should be brought under the same roof.[113]

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109. Bresnahan & Greenstein, *supra* note 104, at 20–21.

110. *See* Wesley M. Cohen & Daniel A. Levinthal, *Absorptive Capacity: A New Perspective on Learning and Innovation*, 35 ADM. SCI. Q. 128, 128 (1990). *See also* Joris Knoben & Leo A.G. Oerlemans, *Proximity and Inter-Organizational Collaboration: A Literature Review*, 8 INT. J. MANAG. REV. 71, 77–78 (2006).

111. *See* Cohen & Levinthal, *supra* note 110, at 130–31.

112. Ronald Coase, *The Nature of the Firm*, 4 ECONOMICA 386, 397 (1937); Steven N.S. Cheung, *The Contractual Nature of the Firm*, 26 J. LAW ECON. 1 (1983); *See* Oliver E Williamson, *The Vertical Integration of Production: Market Failure Considerations*, 61 AM. ECON. REV. 112, 112–14 (1971).

113. *See* David J. Teece et al., *Understanding Corporate Coherence*, 23 J. ECON. BEHAV. ORGAN. 1, 18–19 (1994); PAVEL PELIKAN, *Can the Innovation System of Capitalism Be Outperformed*, *in* TECHNICAL CHANGE AND ECONOMIC THEORY 370 (Giovanni Dosi et al. eds., 1988); Benjamin Klein, Robert G. Crawford & Armen A. Alchian, *Vertical Integration, Appropriable Rents and the Competitive Contracting Process*, 21 J. LAW ECON. 297 (1978); Id. at 794 (describing the essence of the firm as a contractual structure with: 1) joint input production, 2) several input owners, 3) one party who is common to all the contracts of the joint inputs, 4) who has rights to renegotiate any input's contract independently of contracts with other input owners, 5) who holds the residual claim, 6) who has the right to sell his central contractual residual status); Bruce Kogut & Udo Zander, *Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology*, 3 ORG. SCI. 383 (1992) (quoting "Firms exist because they provide a social community of voluntaristic action structured by organizing principles that are not reducible to individuals," at 384); MORRIS SILVER, ENTERPRISE AND THE SCOPE OF THE FIRM: THE ROLE OF VERTICAL INTEGRATION 17 (1984) ("[The entrepreneur's] problem is that he cannot, at reasonable cost, convey his implausible 'secret' to those with the technical capabilities needed to produce the required operations at the lowest cost"); EDITH TILTON PENROSE, THE THEORY OF THE GROWTH OF THE FIRM (1995).

For high-technology firms there is a third aspect, which indicates that, as a matter of technical sense, functions and components that are closely intertwined should be grouped together in the same module.[114] The idea is that interactions within modules are more efficient than interactions between modules, because external-to-the-module interactions impose an overhead cost to the completion of an operation, and therefore they should be limited. When all functions that exhibit high interdependencies are grouped in appropriately defined modules the system performs optimally.

Importantly for our purposes here, modules do not have to remain static. As technical realities change, the functions performed by modules can be rearranged, or removed completely, or new functions can be introduced into the system to accommodate new functionality that is dictated by the principles of efficiency and progress.[115] In the process, modules that were thought to fall exclusively under one level of the value chain can expand (or shrink) to include operations that belonged in another part.

These changes are accordingly reflected in firms' boundaries. Firms constantly re-evaluate their position in the mobile industry value chain and might decide to change their boundaries to engulf (or discard) some functionalities and roles because this is the most efficient scope of operation on technical grounds.[116] At any given moment, technology designers seek and delineate their products' and services' "natural boundaries,"[117] and, in the process, enter new markets by internalizing the production of resources that they used to procure as external complements. This brings used-to-be complements into a competing relationship with the newly enlarged firms. Under these circumstances, should a firm exclude a complement or distribution channel from the market, the competitive response may not only come from its direct horizontal competitors, but also from firms that will expand upstream or downstream to fill in for the excluded complement, or create an alternative distribution channel, if doing so can be technically efficient.

There are indeed several examples of firms that originated in one layer in the value chain and expanded vertically with great success and in only a

114. *See* CARLISS YOUNG BALDWIN & KIM B. CLARK, *Design Rules: The Power of Modularity* 64, 70 (2000); *See also* CARLISS BALDWIN & KIM CLARK, *Modularity in the Design of Complex Engineering Systems*, *in* COMPLEX ENGINEERED SYSTEMS SE-9 175 (Dan Braha, Ali A Minai, & Yaneer Bar-Yam eds., 2006); Herbert A Simon, *The Architecture of Complexity*, 106 PROC. AM. PHILOS. SOC. 467, 474–77 (1962); Ron Sanchez & Joseph T. Mahoney, *Modularity, Flexibility, and Knowledge Management in Product and Organization Design*, 17 STRATEG. MANAG. J. 63, 65 (1996).

115. BALDWIN & CLARK, MODULARITY IN THE DESIGN OF COMPLEX ENGINEERING SYSTEMS at 156, 180.

116. Kevin Boudreau, *The Boundaries of the Platform: Vertical Integration and Economics Incentives in Mobile Computing,* at 2-3 (MIT Sloan Working Paper, 2006); Annabelle Gawer & Rebecca M. Henderson, *Platform Owner Entry and Innovation in Complementary Markets: Evidence from Intel*, 16 J. ECON. MANAG. STRATEG. 1, 3–6 (2007).

117. BALDWIN & CLARK, *supra* note 114, at 64 (speaking of a "natural division" between parts in modular systems).

matter of few years. Table 1 shows the markets the big five digital companies (Amazon, Apple, Facebook, Google, Microsoft) have expanded into over the years. It is striking, not only that they are present in multiple markets, but also that they expanded to them rapidly. Amazon, Facebook and Google have been in existence for twenty years or fewer, and in this time, they expanded into more than ten markets each (the table only shows major markets).

	Amazon	Apple	Facebook	Google	Microsoft
Advertising platform	• (2002)		• (2009/2012)	• (2003)	• (2006)
AI assistant app	• (2015)	• (2014)	• (2017)	• (2016)	• (2014)
AI assistant devices	• (2015)			• (2016)	
AI infrastructure	• (2015)			• (2015)	
App store	• (2011)	• (2008)	• (2007)	• (2008)	• (2009/2010)
Browser	• (2011)	• (2003)		• (2008)	• (1995)
Cloud services (businesses)	• (2006)			• (2011)	• (2010)
Cloud services (consumers)	• (2011)	• (2011)		• (2012)	• (2007)
Computer accessories		• (1977)	• (2016)	• (2014)	• (1982)
Content distribution	• (1998/2007)	• (2001)		• (2006/2011)	• (1996)
E-commerce	• (1994)		• (2007)		
Maps		• (2012)		• (2005)	• (2010)
Messaging/chat		• (2011)	• (2011)	• (2005)	• (1996/1999)
Office tools		• (1979)		• (2006)	• (1983)
OS (Desktop)		• (1978/1984)		• (2011)	• (1981/1985)
OS (Mobile)	• (2012)	• (2007)		• (2008)	• (2010)
Payment services		• (2014)	• (2015)	• (2011)	
PC		• (1978)			
Physical retail	• (2015)	• (2001)			• (2009)
Search (general)				• (1997)	• (1998/2005)
Search (specialized)	• (1994/2002)		• (2013)	• (2002)	• (2009)
Smartphones	• (2014)	• (2007)		• (2010/2016)	• (2010)
Social networks			• (2004)	• (2010)	
Tablets	• (2011)	• (2010)		• (2012/2016)	• (2012)

TABLE 1: MARKETS IN WHICH AAFGM ARE PRESENT, AND DATES OF ENTRY.

Over the years, the competitive pressure and the enhanced conditions of competitive entry helped shape an environment where anticompetitive exclusion was harder to achieve. For instance, Google's entry into the mobile operating system market with the open-source Android undercut Apple's dominance and caused it to loosen its infamous tight grip on its ecosys-

tem.[118] In a speech that went viral in mid-2013 Tim Cook, Apple's CEO, famously stated "I think you will see us open up more in the future,"[119] and some commentators have even suggested that Apple became more open than Google.[120] In a different context, Microsoft's exclusionary strategies against complements such as Java in the late 90s would not make any business sense in the competitive environment of only a few years later with Apple's introduction of Safari, Google's introduction of Chrome, and the popularization of other browsers (e.g. Mozilla Firefox). Vertical expansion into the browser market changed the competitive dynamics in the direction of aiming for maximum compatibility and versatility—not exclusion—and indeed it is on those features that browsers compete today. To take mobile phones as another example, it used to be the case that mobile operating systems and mobile phone devices were an integrated whole (iPhone/iOS, Nokia/Symbian, Blackberry/Blackberry OS), making exclusion in the devices market both a possibility and a concern. In the last decade, Microsoft, Google, Mozilla, Ubuntu, and other companies that were present in neighboring markets developed competing mobile operating systems that were not tied to devices of specific manufacturers, but were licensed (some for free) to any manufacturer that met their technical requirements, providing ample choice to device manufacturers and network operators. These dynamics are found in the nascent market for artificially intelligent personal assistants as well, where Amazon is seen as the pioneer with Amazon Echo. As expected, Amazon tied the Echo device to its e-commerce and content delivery services (Amazon Prime, Amazon Video, Amazon Music, etc.).[121] For anyone concerned that alternative AI personal assistants or providers of complementary/input services to AI personal assistants would be excluded if Amazon dominated the market, the answer came fairly quickly from Google, which, harnessing its expertise in various related markets, introduced its own device, Google Home. Google, in a similar fashion to Amazon, promotes its own affiliated services through Google Home (Google Music, YouTube etc.), and competes with Amazon as systems (rather than as components).[122] What is interesting is that Amazon, in response. decided to unbundle the AI element of

118. Michael Vakulenko, *Mobile Platforms: The Clash of Ecosystems*, SLASHDATA (Nov. 7, 2011), https://www.slashdata.co/blog/2011/11/new-report-mobile-platforms-the-clash-of-ecosystems; Justin Fox, *Why Apple Has to Become More Open*, HARV. BUS. REV. (Mar. 11, 2013), https://hbr.org/2013/03/why-apple-is-going-have-to-bec.html.

119. Ina Fried, *Could Apple Be Getting Just a Bit More Open?*, ALLTHINGSD (May 28, 2013), http://allthingsd.com/20130528/could-apple-be-getting-just-a-bit-more-open/.

120. Christopher Mims, *It's Official: Apple Is Now More 'Open' than Google*, MIT TECH. REV. (Aug. 4, 2011), https://www.technologyreview.com/s/424925/its-official-apple-is-now-more-open-than-google/.

121. See Joanna Stern, *Google Home vs Amazon Echo: Which Robot Do You Let Into Your Life?*, WALL ST. J. (Nov. 7, 2016), https://www.wsj.com/articles/google-home-vs-amazon-echo-which-robot-do-you-let-into-your-life-1478544438.

122. *Id.*

Amazon Echo from the device and publish its APIs, so that application developers and device manufacturers can use it.[123] This opens up the technology to market players that are unaffiliated with Amazon, further removing fears of effective exclusionary practices in the face of systems competition with Google. Apple is also expected to use its expertise in AI personal assistants to introduce a device like Echo and Home, a development that will also increase substitutability.[124]

What derives from the exposition above is that companies exploit their technical capabilities in one market to move up and down the value chain with ease and speed, which was never before possible, making entry plausible and effective.[125] Firms that were once confined in one layer of the value chain and served as complements for firms in other layers can quickly and efficiently develop expertise in other layers and a good understanding of the end service or product, and can therefore tweak their technology to move upstream or downstream and expand to another level too. If a firm, then, decides to exclude inputs or foreclose distribution channels, thereby creating unmet demand in the market, these "technologically adept" firms are waiting in the wings to fill in.

To be sure, the ability of firms to move upstream or downstream as they develop comparable technical expertise can harm competition for the same reasons it can enhance it. The vertical expansion of a dominant firm in one layer to adjacent levels of production is at the core of the fears surrounding the leveraging theory of exclusion (using market power in one layer to expand power into another). This, for example, was a common concern in the early life of Java. Java was originally developed as a middle layer between the operating system and the software that ran on top of it. It was seen as a platform layer distinct from that of the applications that were designed for Java and from the underlying operating system. In this configuration Sun—the company behind Java—was not in a competing relationship with developers of Java applications. However, the growing popularity of Java raised fears that Sun would enter the applications layer too. As Garud et al. explain:

> Such concerns were heightened by Sun's introduction of Java products that competed with those offered by other members of the Java collective. Even ardent supporters were afraid that Sun's control would give it undue advantage when competition intensified in the Java product-market. Pat Sueltz, then general manager of Java

123. Taylor Martin, *7 Things Amazon Echo Can Do That Google Home Can't*, CNET (Jan. 8, 2018), https://www.cnet.com/how-to/amazon-echo-things-alexa-can-do-that-google-home-cant/.

124. Nick Statt, *Apple Is Reportedly Building a Siri Speaker to Rival Amazon's Echo*, THE VERGE (May 24, 2016) https://www.theverge.com/2016/5/24/11763836/apple-siri-speaker-amazon-echo-alexa-google-home-ai.

125. *See generally* Bresnahan & Greenstein, *supra* note 104, at 2 ("[companies] that had previously supplied different segments, now compete for the same customers.").

> software at IBM, suggested: "Sun. . . should establish the standard and compete above it. To the extent that Sun has any advantage, it limits the creativity of their partners."[126]

But the fact that vertical mobility can cut both ways does not detract from the theory. As a matter of principle any factor that lowers barriers and facilitates entry in the market should be welcome. The fact that technological proximity makes entry and expansion into other markets easier and can form a stepping stone for abuse of market power in neighboring markets is a secondary concern that becomes valid only if market power has been accumulated in the principal market in the first place.[127] But, since the entry argument applies to the principal market alike, one should welcome the enhanced conditions digital markets create for easier and entry.

B. *Flexible Locus of Functionality*

The previous section showed that the technology-intensive nature of the digital markets creates the incentives and conditions for increased entry and mobility, such that the pressure resulting from supply-side substitution lowers the plausibility of anticompetitive exclusionary effects.

This section identifies yet another source of substitution in the form of the introduction of a new *locus* in the value chain, where content, services, application, or functionality can be developed, hosted and offered from. A new locus represents a means of providing content, services, or applications that is new to the value chain. It does not simply result in the entry of firms in the existing structure of the market, it rather changes the industry structure to offer a new way of doing things. This is possible because the technical nature of digital markets allows greater flexibility in the relocation or replication of functionality along the value chain, thereby creating competition in new parts of the value chain and adding to the list of competitive sources that constrain firms' bottleneck behavior.

Probably the most well-known illustration of this feature is Java's business model as highlighted by its battle with Microsoft.[128] Java is technically a programming language, and its innovation lies in the "write once, run everywhere" ability, which means that once an application is developed for Java on a given platform (e.g. the Microsoft Windows operating system) it can run on any platform without the need to be recompiled (e.g. on a Java-enabled mobile phone).[129] This revolutionary feature formed an operating envi-

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126. Raghu Garud, Sanjay Jain & Arub Kumaraswamy, *Institutional Entrepreneurship in the Sponsorship of Common Technological Standards: The Case of Sun Microsystems and Java*, 45 ACAD. MGMT. J. 196, 204 (2002).

127. *See* SULLIVAN, GRIMES & SAGERS, *supra* note 31, at 113.

128. *See, e.g., Microsoft*, 253 F.3d 34, 74 (D.C. Cir. 2001).

129. *See Java Soft Ships Java 1.01*, TECH INSIDER (Jan 23, 1996), http://tech-insider.org/java/research/1996/0123.html ("Java's write-once-run-everywhere capability along with its

ronment that allowed Java software to run regardless of the underlying operating system, and, in effect, to create a *new middle layer* between the operating system and the applications that ran on top of it, which broke the link and interdependence between an operating system's APIs and the applications.

Microsoft vehemently fought Sun (the company behind Java) and attempted to exclude it from Microsoft Windows by introducing incompatibilities between Microsoft's and Sun's respective versions of Java Virtual Machine.[130] Microsoft was concerned that the independent evolution of Java might mean that a new platform for applications development would emerge, one that did not depend on Windows to run.[131] Although Java was not an operating system and hence did not compete in the same (horizontal) market as Windows, the fear was that it could replace Windows "as the ubiquitous platform for software development" and usurp a lot of its functionality directly competing with it as a platform for software development.[132]

In this situation, even if Windows wanted to exclude an application, it could only do so when the application ran directly on Windows, not if it could run on Java's intermediate layer (at least not without sabotaging Java). Potential exclusionary practices on the Windows' side could therefore be curtailed not because of the emergence of a new operating system, but because part of the functionality of the operating system would have migrated elsewhere within the value chain, namely the new layer introduced by Java.

Internet browsers present another example of functionality relocation. For the same reason that Microsoft saw Java as a threat, namely that it could provide a new layer for applications to run on, thereby bypassing the limita-

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easy accessibility have propelled the software and Internet communities to embrace it as the de facto standard for writing applications for complex networks.").

130. *Microsoft*, 253 F.3d at 74-75 ("The District Court held that Microsoft engaged in exclusionary conduct by developing and promoting its own JVM. Sun had already developed a JVM for the Windows operating system when Microsoft began work on its version. The JVM developed by Microsoft allows Java applications to run faster on Windows than does Sun's JVM, but a Java application designed to work with Microsoft's JVM does not work with Sun's JVM and vice versa." (internal citations omitted)). The claim here is not that Microsoft violated antitrust laws on the basis of its exclusionary conduct. As the court noted "[i]n order to violate the antitrust laws, the incompatible product must have an anticompetitive effect that outweighs any procompetitive justification for the design. Microsoft's JVM. . . allows Java applications to run faster on Windows. . . and does not itself have any anticompetitive effect. Therefore, we reverse the District Court's imposition of liability for Microsoft's development and promotion of its JVM."). *See also* Garud, Jain, & Kumaraswamy, *supra* note 126, at 204.

131. In a 1995 memo addressed to Microsoft's executives Bill Gates wrote: "A new competitor 'born' on the Internet is Netscape. Their browser is dominant, with 70% usage share, allowing them to determine which network extensions will catch on. They are pursuing a multi-platform strategy where they move the key API into the client to commoditize the underlying operating system.' Memorandum from Bill Gates to Exec. Staff (May 26, 1995) (archived at https://www.justice.gov/sites/default/files/atr/legacy/2006/03/03/20.pdf).

132. *Microsoft*, 253 F.3d at 74.

tions and controls of the operating system, Microsoft also saw competing internet browsers (and mainly Netscape Navigator) as a threat to its operating system.[133] Internet browsers could serve as a platform to run services on, and they could provide functionality that up until that point fell under an operating system's ambit.

What is most interesting for the purposes of the analysis of exclusion here is the substitutability potential the merging of Internet browsers and operating systems creates. Google, for instance, recently announced Andromeda, an operating system that results from the merging of Chrome OS (Google's operating system which is based on the Chrome internet browser) and Android (Google's mobile operating system). Andromeda can run on personal computers, tablets and phones, and can run applications that are written for Android or for Chrome OS.[134] The dual nature of Andromeda allows it to operate and create competitive pressure in multiple markets and layers. This could allow Andromeda to serve as an effective substitute to Windows, whose traditional and most powerful advantage has been the network effects around compatible applications, something that Andromeda can counter by exploiting the popularity of the Android applications ecosystem.

Moving on, an unnoticed but far-reaching transformation of how applications, services, and products are delivered to users comes from the lower layers of online markets, changing the dynamics of substitutability in a fundamental way never before seen. Until now the model for offering communication services has been based on two modalities: services that relied on traditional telecommunications networks, including telephony, text messages, voice mail, etc., and internet services, which include all services accessible through the public internet (other non-internet IP networks are available but these are normally reserved for specialized business needs and not open to the public). The Internet is regarded as the main driving force for innovation in products, services, and applications because of the general-purpose nature of the IP protocol.[135] To the contrary, traditional telecommunications networks, which were based on a different less flexible protocol

133. *Id.* at 59.

134. Ron Amadeo, *Android + Chrome = Andromeda: Merged OS Reportedly Coming to the Pixel 3*, ARS TECHNICA (Sept. 26, 2016, 2:55 PM), https://arstechnica.com/gadgets/2016/09/android-chrome-andromeda-merged-os-reportedly-coming-to-the-pixel-3/.

135. Barry Leiner et al., *The Past and Future History of the Internet*, 40 COMM. ACM 102, 104 (1997) ("[t]he Internet was not designed for just one application but as a general infrastructure on which new applications could be conceived"); *see also* David D. Clark, *Interoperation, Open Interfaces and Protocol Architecture*, *in* THE UNPREDICTABLE CERTAINTY: WHITE PAPERS INFORMATION INFRASTRUCTURE THROUGH 2000 133, 133–34 (NII 2000 Steering Committee, Computer Science and Telecommunications Board, Commission on Physical Sciences, Mathematics, and Applications ed., 1997).

stack called SS7, were created with a limited number of services in mind, which were controlled by the respective network owner and operator.[136]

What we are beginning to see now is that communications networks are all transitioning to IP-based technologies, which means that service and application delivery architectures are no longer designed for a specific use or function, but rather to support and host a variety of services, functionalities, and applications. As a result, new communications networks can replicate the internet model, and can allow the hosting of functionality in layers of the value chain that were not traditionally associated with it. This new option creates additional sources of supply and substitutability in services and applications making anticompetitive exclusion harder to establish.

There are various technologies that enable the kind of flexibility described here. The IP Multimedia Subsystem (IMS) is one popular implementation, and set the tone for the future telecom companies want to move towards.[137] IMS forms part of an overhaul that mobile communications networks are undergoing, called System Architecture Evolution (SAE),[138] and is a standardized architecture for the transmission of multimedia (including voice, text messages, video) and other traffic.[139] SAE/IMS, for the first time since the commercialization of the internet, offer an alternative general-purpose platform, encompassing all players along the value chain. As Siemens' Director for Fixed-Mobile Convergence Solutions put it: "IMS is designed to provide *operators* with the means to satisfy the growing demand for rich, diverse communications services. . . For *vendors* and new application providers, the IMS architecture supports rapid and efficient service creation. For *users*, IMS makes it possible to access multiple services in the course of the same call or session."[140] This environment can serve as a parallel—if more limited—platform for service, application, and content creation and delivery, the first time this has ever happened outside of the internet context (open to the public).

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136. RAY HORAK, TELECOMMUNICATIONS AND DATA COMMUNICATIONS HANDBOOK 182 (2007).

137. *See* Press Release, IHS, Service Providers Optimistic about Moving IMS Networks to NFV, Rate Vendors (July 9, 2015), https://technology.ihs.com/545822/service-providers-optimistic-about-moving-ims-networks-to-nfv-rate-vendors; *cf.* Darren McQueen, *The Momentum Behind LTE Adoption*, 47 IEEE COMM. MAG. 44 (2009); Alexander Harrowell, *IMS: Two Visions of the Telecoms Future*, 130 MOBILE TELECOMM. INT'L 1 (2006).

138. *See generally* Kalyani Bogineni et al., *LTE Part II: Radio Access*, 47 IEEE COMM. MAG. 40 (2009); Kalyani Bogineni Kalyani et al., *LTE Part I: Core*, 47 IEEE COMM. MAG. 40 (2009).

139. Antonio Cuevas et al., *The IMS Service Platform: A Solution for Next-Generation Network Operators to Be More than Bit Pipes*, 44 IEEE COMM. MAG. 75, 76-77 (2006). *See also* Gilles Bertrand, The IP Multimedia Subsystem in Next Generation Networks (May 30, 2007) (unpublished manuscript) (on file with author).

140. Felipe Alvarez del Pino & Gary Iosbaker, *IMS: Application Enabler and UMTS/HSPA Growth Catalyst*, in BUSINESS MODELS AND DRIVERS FOR NEXT-GENERATION IMS SERVICES (International Engineering Consortium ed., 2007) (emphasis added).

IMS is not the only emerging alternative architecture; other hybrid architectures have appeared taking advantage of the universal and general purpose nature of IP.[141] Over the past few years communications applications and services have been deployed on such architectures as infrastructure-as-a-service (IaaS),[142] platform-as-a-service,[143] network-as-a-service (NaaS),[144] and network virtualization.[145] Bell Labs/Alcatel-Lucent has described this general trend as follows: "It is envisaged that services and applications will migrate to a cloud-computing paradigm where thin-clients on user devices access, over the network, applications hosted in data centers by application service providers."[146] These technologies provide the necessary hardware and software to develop and deploy services and applications, which are delivered to end users through last mile infrastructure operators. This model is becoming increasingly popular, including among mobile virtual network operators (MVNOs), who until recently were limited to whatever network capabilities the host carrier supported, but can now have their own plat-

141. On the distinction between the Internet and other (potentially open) IP-based platforms *see* Kimberly C. Claffy & David Clark, *Platform Models for Sustainable Internet Regulation*, presented at the 41st Research Conference on Communication, Information and Internet Policy (Aug. 15, 2013), *available at* http://ssrn.com/abstract=2242600 (discussing alternative IP platforms).

142. *See, e.g.*, TATA COMMUNICATIONS, INFRASTRUCTURE AS A SERVICE: FULFILLING THE PROMISE OF CLOUD COMPUTING (2010), http://www.tatadocomo.com/business/download/WhitePaper-Infrastructure-as-a-Service.pdf; What is IaaS?, INTEROUTE, http://www.interoute.com/what-iaas (last visited Jan. 30, 2018).

143. Vânia Gonçalves & Pieter Ballon, *Adding Value to the Network: Mobile Operators' Experiments with Software-as-a-Service and Platform-as-a-Service Models*, 28 TELEMATICS AND INFORMATICS 12, 12 (2011).

144. *See, e.g.*, MARCO HOFFMANN & MARKUS STAUFER, NETWORK VIRTUALIZATION FOR FUTURE MOBILE NETWORKS: GENERAL ARCHITECTURE AND APPLICATIONS (2011); Ashiq Khan et al., *Network Sharing in the Next Mobile Network: TCO Reduction, Management Flexibility, and Operational Independence*, 49 IEEE Comm. Mag. 134 (2011); See also Press Release, Fujitsu Unveils 'Network as a Service Concept,' (May 16, 2007), http://www.fujitsu.com/global/about/resources/news/press-releases/2007/0516-02.html.

145. See, e.g., Jonathan S. Turner & David E. Taylor, Diversifying the Internet, Applied Research Laboratory Washington University in St. Louis, Sept. 2005, https://www.arl.wustl.edu/Publications/2005-09/globecom05divNet.pdf; Flavio Esposito, Ibrahim Matta & Vatche Ishakian, Slice Embedding Solutions for Distributed Service Architectures, Boston University Computer Science Technical Reports, Feb. 5, 2011, http://www.cs.bu.edu/techreports/pdf/2011-025-slice-embedding.pdf; Diego Lopez et al., Impact of SDN/NFV on Business Models, Institute of Electrical and Electronics Engineers, Jan. 2016, https://sdn.ieee.org/newsletter/january-2016/impact-of-sdn-nfv-on-business-models.

146. Fang Hao et al., Enhancing Dynamic Cloud-based Services Using Network Virtualization, *in* PROCEEDINGS OF THE 1ST ACM WORKSHOP ON VIRTUALIZED INFRASTRUCTURE SYSTEMS AND ARCHITECTURES 37, 37 (2009).

form.[147] In fact, as Wi-Fi is becoming more prevalent, reliance on traditional carriers is decreasing even further.[148]

Under these changing technological conditions, given the multiple options for service, application, and content development and delivery, the effect of the ability to exclude in one platform is weakened because of the possibility to turn to other platforms. Admittedly, much of the competitive potential described here has yet to materialize, and one should therefore be careful not to overestimate its dissuasive and suppressive effect. However, it is worth noting and anticipating the kind of substitutability options made available by newer technologies, so that when they reach maturity, courts and authorities will be ready to acknowledge them and factor them in. Any forward-looking measure would do well to consider not only the state of the technology but also prevailing trends. For instance, the US Court of Appeals in the Microsoft case noted that "[a]s the record in this case indicates, six years seems like an eternity in the computer industry. By the time a court can assess liability, firms, products, and the marketplace are likely to have changed dramatically. This, in turn, threatens enormous practical difficulties for courts considering the appropriate measure of relief," noting further, however, that "[e]ven in those cases where forward-looking remedies appear limited, the Government will continue to have an interest in defining the contours of the antitrust laws so that law-abiding firms will have a clear sense of what is permissible and what is not."[149]

C. *Competitive Pressure and Dissuasive Effects from Existing Actors*

The kind of competitive pressure documented so far stems either from entry into the bottleneck market where exclusionary practices are feared, or from the relocation or replication of functionality, such that firms may find their role and function usurped or replicated by firms that would not normally count as competitors. In either case, supply side substitution becomes stronger.

At the same time, the ability to effectively exclude depends also on the pressure firms are subject to from other firms along the value chain, even if these do not enter their market or take over their role or functionality. This is because firms do not exist in a vacuum. Rather, they coexist with other firms in the value chain, and they are all essentially vying for the same reward: a

147. Dan Meyer, *NFV and SDN PoCs Continue in 2016, Greater Adoption in 2017*, RCRWirelessNews (Dec. 29, 2015). *See also* Doyle Lee, *NFV Adoption to Transform Telecommunications Infrastructure*, GIGAOM Research (Feb. 25, 2014), http://events.windriver.com/wrcd01/wrcm/2016/08/WP-gigaom-research-report-nfv-adoption-to-transform-telecommunications-infrastructure.pdf.

148. *See, e.g.*, Republic Wireless, https://republicwireless.com (last visited Jan. 30, 2018); TextNow Wireless, https://www.textnow.com/wireless (last visited Jan. 30, 2018).

149. *Microsoft*, 253 F.3d at 49.

cut from the profits the value chain can generate.[150] In this context, the necessary market power to exclude is not only assessed vis-à-vis competitors, but also complements. The strategic importance of complements in the composition of the final product or service that is delivered to users can influence the incentive and ability of firms to profitably exclude, and therefore should also be considered in the assessment of exclusion. Technological proximity and interdependence between firms in digital markets magnifies this effect and adds to the supply side competitive pressure as shown below.

1. Shifts of Power due to Technological Proximity

Technological proximity, as explained previously, enables firms to jump from one layer to another and, in the process, create competitive pressure and increase supply side substitution. On top of that, technological proximity facilitates the exchange of power between players in a way that can weaken market power by moving the center of value along the value chain. When an actor around whom a platform or a technology revolves loses control over the platform or technology, their relevance and market power suffer, and along with it the ability to enforce an exclusionary policy that harms the platform or technology.

Systems that consist of multiple components (a common feature of digital systems), are not necessarily locked in a fixed allocation of value and importance among their parts and components.[151] The total value may remain the same, but the internal allocation and the actors representing each part can change due to the "vertical competition for control of a platform among the sellers of its various components."[152] Even in complex technical systems which comprise several parts, components and actors, at any given time only one or a few parts/actors of the value chain can be those that define its general architectural shape.[153] These are the ones around which the rest of the parts will develop. As the system evolves in time, it is possible that another part/actor will take the lead as the epicenter of the system's design. The system will then coagulate around that new keystone component.

In such contexts it is often unclear which standard, platform, function or component will become the strategically most important one, around which value and market activity will coalesce, and it is also entirely possible that

150. This concept is well summarized in the one monopoly rent theorem. *See* ROBERT BORK, THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF, 372-74 (1978); VISCUSI, HARRINGTON, AND VERNON, *supra* note 43, at 248-51.

151. *See, e.g.*, Hemant Kumae Sabat, *The Evolving Mobile Wireless Value Chain and Market Structure*, 26 TELECOMM. POLICY 505 (2002); Joe Peppard & Anna Rylander, *From Value Chain to Value Network: Insights for Mobile Operators*, 24 EUR. MGMT. J. 128 (2006).

152. *See* Bresnahan and Greenstein, *supra* note 104, at 23.

153. Carliss Young Baldwin & Jason C. Woodard, *The Architecture of Platforms: A Unified View*, in PLATFORMS, MARKETS AND INNOVATION, 24–25 (Annabelle Gawer ed., 2009).

none is actually sufficiently defined, in which case competition between and within them for one to emerge (temporarily) victorious is inevitable.[154] As this process unfolds, the various components in a system are not only constrained by their counterparts in other systems, but also within the system itself by their own complements.[155]

The most representative example in the literature is how IBM lost leadership of the personal computer (PC) platform to Microsoft and Intel.[156] In the early 1980s IBM introduced its personal computer, which it decided to build on a modular architecture and rely on Microsoft's Windows for the operating system and on Intel for the processor.[157] Despite its initial success, the fact that other vendors could use Microsoft Windows and Intel to build their own "IBM-compatible" personal computers weakened IBM's position in the market.[158] IBM responded (belatedly) by introducing proprietary interfaces and its own operating system (OS/2), but control had already shifted from IBM to the "Wintel" duo. IBM was relegated to just another personal computer manufacturer. This example highlights how two firms that were not directly competing with IBM, but to the contrary were a big part of the "personal computer platform" that IBM popularized, managed to take away control from IBM and in doing so exposed IBM to much fiercer competition from other manufacturers, who absent the enabling factor of the Wintel duo might not have been able to compete effectively with IBM.

The recent Netflix–Comcast controversy provides yet another example. The controversy was about Comcast allegedly slowing down Netflix traffic to end users because Netflix refused to compensate Comcast for direct interconnection at the rate Comcast thought fair.[159] The exclusionary effect against Netflix is obvious considering how important bandwidth is in delivering video to consumers. Many analysts sided with Netflix, accusing Comcast of exercising its termination monopoly power to get concessions out of

154. Pieter Ballon, *Platform Types and Gatekeeper Roles: The Case of the Mobile Communications Industry*, in THE DRUID SUMMER CONFERENCE, 4 (2009); *See also* Kevin Boudreau, *Open Platform Strategies and Innovation: Granting Access vs. Devolving Control*, 56 MGMT. SCI. 1849 (2010).

155. *See* Joseph Farrell, Hunter K Monroe & Garth Saloner, *The Vertical Organization of Industry: Systems Competition Versus Component Competition*, 7 J. ECON. MANAG. STRATEG. 143 (1998) (where the authors compare competition between systems as a whole and between components of systems).

156. For a relevant account *see* Bresnahan and Greenstein, *supra* note 104.

157. *See generally* CHARLES FERGUSON & CHARLES MORRIS, COMPUTER WARS: HOW THE WEST CAN WIN IN A POST-IBM WORLD 7–10 (BeardBooks ed., 1993) (describing the specifications and designs of IBM's personal computer).

158. Burton Grad, *A Personal Recollection: IBM's Unbundling of Software and Services*, 24 INST. ELECTRICAL ELECTRONICS ENGINEER ANNALS ANNALS HIST. COMPUTING 64 (2002).

159. *See* Susan Crawford, *The Cliff and the Slope*, WIRED (Oct. 30, 2014, 07:00 AM), https://www.wired.com/story/jammed/.

Netflix.[160] This criticism reflected the traditional view that the network operator is the bottleneck, and in the position to exercise exclusionary power. But this account likely misrepresents the balance of power between the two companies here: ISPs like Comcast have for years expressed their discontent with the fact that Netflix allegedly doesn't pay its fair share relative to the volume it offloads into ISPs' networks, but they only recently managed to enter into an agreement with it.[161] Interestingly, the environment in which the Comcast-Netflix dispute arose is largely unregulated, which means that if indeed the power balance was clearly in favor of Comcast, it should not have been too hard for it to exercise it. To the contrary, Netflix had good reasons to believe that it could escape charges, as it had become so valuable to ISPs' consumers, that it knew ISPs would not block or throttle it (in other words, foreclose it from the market).[162]

In these examples, what we notice is that, because of the complementarity between the layers in the value chain and, because the technical details and specifications of the end product and service that will be delivered to consumers are defined by different and often competing firms, power is divided among them. In this co-dependent relationship it is unknown ex ante around which part of the value chain value will concentrate,[163] and in fact there is no reason why the distribution of power must remain fixed. Precisely because the industry is conducive to this kind of power reshuffling among actors, the observation of market power concentration in the hands of a certain actor should not inexorably point to the conclusion of a market failure in need of regulation, but it should rather provoke an inquiry into potential sources of counter-balancing competitive pressure, something that at first sight might not be immediately apparent.

The argument here is not that exclusionary power is *irrelevant*, but rather that it is *relative*. Firms are routinely constrained not only by their competitors but also by their partners, and the balance of power among them can and does change. In observing—and regulating—exclusionary power,

160. *See id.* The FCC also said it was ready to hear complaints on the dispute. *See* Jon Brodkin, *Netflix, Call Your Lawyers: FCC Is Ready for Interconnection Complaints*, ARS TECHNICA, (Feb. 27, 2015, 05:35 PM), https://arstechnica.com/information-technology/2015/02/netflix-call-your-lawyers-fcc-is-ready-for-interconnection-complaints/.

161. *See* Karl Bode, *No, Netflix's New Deal With Comcast Probably Won't Destroy The Internet. Yet.*, TECHDIRT, (Feb. 24, 2014, 09:50 AM), https://www.techdirt.com/articles/20140223/07543426321/no-netflixs-new-deal-with-comcast-probably-wont-destroy-internet-yet.shtml; Dan Raybum, *Inside The Netflix/Comcast Deal and What The Media Is Getting Very Wrong*, SEEKING ALPHA, (Feb. 23, 2014); Sue Zeidler, *Netflix Scrambles Future of TV and Films*, REUTERS (Dec. 1, 2010, 04:23 PM), https://www.reuters.com/article/us-media-summit-netflix/netflix-scrambles-future-of-tv-and-films-idUSTRE6B060E20101201.

162. *See* Marguerite Reardon, *Comcast vs. Netflix: Is This Really About Net Neutrality*, CNET (May 15, 2014, 04:00 AM) https://www.cnet.com/news/comcast-vs-netflix-is-this-really-about-net-neutrality/; Matthew Ingram, *Here's Why Comcast Decided to Call a Truce with Netflix*, FORTUNE (July 5, 2016), http://fortune.com/2016/07/05/comcast-truce-netflix/.

163. *See* Gawer & Henderson, *supra* note 116, at 6–11.

one should keep in mind that close technological proximity and interdependencies may cause power to flow from one part of the value chain into another, having an effect on the ability to effectively exclude.

2. The Continuous Tussle in Network Industries

Like most industries, digital markets are structured around networks of actors who represent different interests. As these interests compete against each other, it is hard for any one player to impose their unilateral will, exclusionary or otherwise. This is a general and rather obvious observation; there is nothing new in saying that different competing interests are represented in a given market, and that the result of competition among them is that harmful business behavior is constrained.

What does make a difference, however, is how closely these competing interests are pitted against each other by virtue of the industry's characteristics. In traditional physical commodities markets, while we do notice the kind of vertical competition coming from complements as explained before (on top of direct horizontal competition), the various layers in the value chain are usually separate in the sense that the design of products or services in one layer is not interlocked with the design of products and services in the other layers, even though they will have to work together to reach consumers. Supermarket shelves have remained the same over the years and yet the products sold on them and the trucks that transport those products have changed. Building techniques and architectural trends have changed even though real estate agencies have remained the same. The tools and machinery used to construct buildings have also changed in response to the new building techniques and architectural trends, but architects, realtors and tool manufacturers need not agree on these changes together in order for each to do their job.

Digital markets are different. They rely on protocols, standards, interfaces, and technologies that have to be commonly agreed and implemented uniformly across all layers that are involved in the delivery of a service or product. For example, an application will not work on an operating system if it does not comply with the operating system's APIs, and the introduction of—say—a quality of service protocol necessitates a series of changes along the value chain, because if one layer does not uphold QoS requirements the entire service collapses.[164] As a result, the design and evolution of value

164. This is the reason why IntServ and DiffServ have generally failed to solve the QoS problem on the Internet, or why transition from IPv4 to IPv6 as well as the approval and implementation of other critical features in the Internet's infrastructure have been very slow. *See*, *e.g.*, Mark Handley, *Why the Internet Only Just Works*, 24 BT TECH. J. 119 (2006). *See also* Geoff Huston, *The Internet – 10 Years Later*, THE ISP COLUMN (June 2008), http://www.internetsociety.org/sites/default/files/10years.pdf.

chains in digital markets is a process that involves the needs and capabilities of multiple layers, all of which attempt to maximize their interests.[165]

This kind of interdependence forces market actors to work together in the development of products and services in a way that the end product and service is the result of a compromise or consensus,[166] and not of the unilateral will of one actor, unless that actor is so dominant as to be able to impose a de facto standard or technology.[167] As Greenstein notes, in highly technical and sophisticated markets the degree of specialization and secularization is such as to lead to "an increase in the number of firms that possess the necessary technical knowledge and commercial capabilities to bring to market some component or service of value to . . . users."[168] He calls this "absence of unilateral bargaining" and brings it as a reason why the internet, despite the fact that it accommodates dominant actors in every part of its value chain, is characterized by "innovative health:"

> In a network with a high degree of technical interrelatedness, there are general gains to all parties from bringing routines into business processes and activities, much like there are gains to adopting standards and platforms to coordinate activities. While there may be no better way to reduce complexity, adopting such routines may require negotiation between multiple parties.[169]

An example that beautifully illustrates this point is the "openness" condition in the C Block of the 700 MHz spectrum that was auctioned in 2008. In that auction, on the insistence of major companies like Google and the Public Interest Spectrum Coalition, the FCC included a term requiring the licensee to provide open platforms for devices and applications, if the win-

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165. *See* MARTIN FRANSMAN, THE NEW ICT ECOCYSTEM 9–10 (Cambridge Univ. Press ed., 2010) ("the four layers [networked elements, network operators, content and applications, consumers] of the system, although hierarchically structured, are interdependent. Each layer depends on the layer (or layers) adjacent to it. For the system as a whole to operate, each layer needs to do its own functional job."). *See also* Peppard & Rylander, *supra* note 151 (examining the evolution of actors in the mobile industry).

166. *Cf.* OPENING STANDARDS: THE GLOBAL POLITICS OF INTEROPERABILITY viii–ix (Laura DeNardis ed., 2011) (where the author explains how complex the standard-setting process is because of the different and competing priorities players bring to the table: "technical standards not only provide technological interoperability but also produce significant political and economic externalities. Battles over standards are sometimes market conflicts between technology companies. . .. [S]tandards are also political, making decisions about individual civil liberties online.").

167. *See* BESEN & SALONER, *supra* note 107, at 181–82.

168. Shane Greenstein, *Innovative Conduct in Computing and Internet Markets*, *in* 1 HANDBOOK OF THE ECONOMICS OF INNOVATION VOLUME I 477, 492 (Bronwyn H. Hall & Nathan Rosenberg eds., 2010).

169. Shane Greenstein, *Glimmers and Signs of Innovative Health in the Commercial Internet*, 8 J. TELECOMM. HIGH TECH. L. 25, 63 (2010).

ning offer exceeded $4.6 billion.[170] If the offer did not exceed that price, the block would be re-auctioned without the openness requirement. Google was one of the most ardent supporters of this condition, because as a service (and later device) provider, it would benefit from end users being able to use its products and services freely without any limitations from the carriers. Google openly declared to the FCC that if and only if an openness requirement is included will it bid at the auction.[171] At the time, Google was not seriously considering becoming an infrastructure provider, and in any case it knew that other companies needed and were willing to pay more for that part of the spectrum.[172] Indeed, Google bid just over the threshold price to make sure that the openness condition would be triggered, but not high enough to actually win the auction (Verizon, which won the C block, paid a total of $9.6 billion for licenses included in the C block).[173]

The outcome of this power play was that Verizon committed to a non-exclusion policy at least for a part of its network, even though it initially opposed this term.[174] The conditions of openness that accompanied the 700 MHz C block were not activated because Verizon caved to competitive pressure by one of its direct competitors or some other player in the value chain.

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170. In the Matter of Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, 22 FCC Rcd. 15258 et seq. (2007) (Second Report and Order). ("[W]e will require only C Block licensees to allow customers, device manufacturers, third-party application developers, and others to use or develop the devices and applications of their choosing in C Block networks, so long as they meet all applicable regulatory requirements and comply with reasonable conditions related to management of the wireless network (i.e., do not cause harm to the network). Specifically, a C Block licensee may not block, degrade, or interfere with the ability of end users to download and utilize applications of their choosing on the licensee's C Block network, subject to reasonable network management," at 15365).

171. Eric Bangeman, *Google Announces Intent to Bid on 700MHz Spectrum Auction, If. . .*, Ars Technica (July 20, 2007), https://arstechnica.com/uncategorized/2007/07/google-announces-intent-to-bid-on-700mhz-spectrum-auction-if/.

172. Glen Chapman, *Verizon, AT&T Win FCC Auction, Google Wins Open Spectrum*, Sydney Morning Herald (Mar. 20, 2008), http://www.smh.com.au/world/verizon-att-win-fcc-auction-google-wins-open-spectrum-20080321-20vv.html.

173. See generally Sandro Brusco, Giuseppe Lopomo & Leslie M. Marx, The "Google Effect" in the FCC's 700 MHz Auction, 21 Inf. Econ. Policy 101 (2009); Saul Hansell, Verizon and AT&T Win Big in Auction of Spectrum, N.Y. Times (Mar. 21, 2008), http://www.nytimes.com/2008/03/21/technology/21auction.html.

174. See In the Matter of Service Rules, supra note 170, at 15360 et seq. (Verizon Wireless argues that imposing an open access business model undermines the auction process and competitive bidding. . . . Verizon Wireless asserts that imposing open access regulations runs contrary to the Commission's "light regulatory touch" for wireless services generally. . .. According to Verizon Wireless, requiring winners of licenses in the 22 MHz block to provide open access would impose an asymmetrical regulatory regime on only one segment of the industry, thus drawing arbitrary distinctions. . . . Also, according to Verizon Wireless, the Commission cannot impose access requirements without violating various sections of the Communications Act and affecting the First Amendment rights of existing providers" (internal citations omitted)); *See* Om Malik, *Verizon Sues, Google Expresses Dismay Over 700 MHz Auction*, Gigaom (Sept. 13, 2007), https://gigaom.com/2007/09/13/verizon-sues-google-expresses-dismay-over-700-mhz-auction/.

They were triggered by a combination of lobbying to convince the FCC to include the relevant terms in the auction rules,[175] and of a company's flexing its financial muscle to achieve favorable rules.[176]

Another example concerns the standardization process of the Office Open XML document standard, which Microsoft sponsored, as it was planning to use it as the main document format for its Office suite. While the standardization process was ongoing, a large number of firms, individuals, and associations coming from across the industry expressed their opposition to Microsoft's technical choices fearing that Microsoft would refuse to make its standard fully open and interoperable—as it pledged—and instead discriminate against or exclude competing software from reading OOXML files and competing open standards, such as the ODF.[177] In the end, after one of the most contentious standardization procedures, the OOXML standard was passed in a form that honored its open nature. In this case, pressure coming from multiple stakeholders in the industry was key to ensuring the representation of a multitude of interests, which were eventually embedded in the technical specifications of the product.

Interestingly, this kind of tussle is not necessarily crystallized in a final result or outcome, but it can be ongoing as the industry evolves. The power games can be ongoing and the supply side map is subject to constant revision. In an influential paper, David Clark, who played a major role in the design of internet protocols, eloquently talks about how engineers should design network elements and software not to accommodate all needs and goals but rather to accommodate indeterminacy. In his own words "[a]ny practicing engineer knows that the process of design is. . . one of *balancing considerations* and resolving tensions to get an acceptable specification"

175. The FCC started considering the conditions after the Public Interest Spectrum Coalition submitted a relevant proposal in its comments. *See Ex Parte Comments of the Ad Hoc Public Interest Spectrum Coalition*, PS DOCKET NO. 06-229 and WT DOCKET NOS. 06-150, 05-211, 96-86, at 9, 18-19 (filed Apr. 3, 2007); In the Matter of Service Rules for the 698-746, 747-762 and 777-792 MHz Bands (Report for Order and Further Notice of Proposed Rulemaking), 22 FCC Rcd. 8064 (2007).

176. At least one analysis of the auction concludes that if it were not for Google's bidding, the openness condition would not have been triggered, because Verizon wasn't planning to meet the lowest threshold price. *See* Brusco, Lopomo, & Marx, *supra* note 173, at 112 ("We can speculate that Verizon's bidding strategy was not to bid on the C-block licenses if no other bidder bid up to the reserve price. Verizon's bidding in the early rounds of the auction is consistent with this. Thus, we speculate that, without Google's participation in the auction, the C-block reserve price would not have been met, triggering a re-auction of that block without the restrictions. In that case, we would expect prices for the C-block licenses that were more in line with the other blocks and other recent spectrum sales.").

177. *See* Ryan Paul, *OOXML Critics: ISO Approval Demonstrates The Need For Reform*, ARS TECHNICA (Apr. 3, 2008), https://arstechnica.com/information-technology/2008/04/ooxml-critics-iso-approval-demonstrates-the-need-for-reform/; DeNardis, *supra* note 166, at vii–ix; Dylan Bushell-Embling, *Bias Claim on Big Office Vote*, SUNDAY MORNING HERALD, Feb. 26, 2008.

(emphasis added).[178] Designing for tussle is to design for variation in outcome "so that the outcome can be different in different places, and [so that] the tussle takes place *within the design*" (emphasis added).[179]

III. Ability to Exclude: Demand Side Considerations

The previous part described how the technological realities of digital markets enable and facilitate competitive response, due to technology-induced entry, or due to pressure from neighboring actors and competing interests, or due to relocation of functionality or value along the production chain. Under these circumstances, the supply side of digital markets becomes less likely to be conducive to the kind of exclusion that can distort the development and provision of products and services.

The supply side is only half the picture. A healthy supply side tells us that rivals (or complements) are ready to supply the market with what the exclusionary firm has deprived it of, but it does not tell us whether, or how easily, demand side actors can purchase substitute products and services, assuming they consider them as such.[180] If consumers find it hard to access or switch to substitute products or services, then intense competition on the supply side will be of little help, as unmet supply will eventually wither. If, on the other hand, there are low or no switching barriers and multiple ways by which consumers can access their desired products and services, then the full potential of enhanced supply side competition can be materialized.

This part focuses on how the technological realities of digital markets enhance the ability of consumers to access products and services. One way by which this is done is multihoming, which is the ability of an actor to subscribe to multiple systems at the same time. Doing so limits the exclusionary power of each system. The other way discussed here is interconnection, which, by creating redundancies, limits the power of each separate actor to generate unilateral results. While the theory of interconnection has been known for a long time, recent technological developments have increased the applicability of interconnection, and are explored further herein.

A. *Multihoming*

Multihoming is the ability of subscribers to join multiple systems (i.e. networks, platforms, etc.) at the same time. This allows them to access multiple environments and to draw complementary utility from all of them.[181]

178. Clark, *supra* note 12, at 463.

179. *Id.* at 466.

180. Demand side actors can be synonymous to consumers if by consumers one means not only end consumers but also purchasers of products and services in any layer of the value chain. In that sense end consumers would be demand side actors, but application developers would also be demand side actors of the operating system market.

181. Jay Pil Choi, *Tying in Two-Sided Markets with Multi-Homing*, 28 J. Indus. Econ. 607, 607 (2010).

Under multihoming, subscribers enjoy the benefits of multiple systems and do not depend exclusively on one of them. In essence, multihoming opens up multiple paths between a source (product, service, application, etc.) and a destination (users, consumers) through the intermediaries along the value chain (operating systems, software delivery platforms, network operators, device manufacturers, etc.). An example of multihoming on the side of mobile application developers is the manufacturing of an application for more than one mobile operating systems (e.g. iOS and Android); an example of multihoming on the users' side is the ability to use both the cellular network and Wi-Fi on a mobile phone; an example of multihoming of intermediate actors is a device manufacturer partnering with more than one mobile operating system developers (e.g. HTC's mobile phones run Android or Windows Mobile).

Under conditions of multihoming, effective exclusion becomes more difficult, because the exclusionary practices of a system do not completely block access to an input or distribution channel as long as one of the sides also subscribes to another system. Put differently, multihoming creates a form of redundancy in the market, and therefore weakens the power position of bottlenecks and limits the effect of exclusionary practices, because it opens up alternative paths to connect actors in the industry.[182] The more extensive multihoming is in every level of the value chain the less power is concentrated in each link, and the easier it becomes for market players to connect to each other.

Further, multihoming expands the potential adoption pool for developers and providers, it creates more options for end users to better serve their preferences, and it results in output increase and price decrease in the market.[183] Additionally, multihoming creates strategic pressure on systems not to exclude for the following reason: in a two-sided system with developers on one side and users on the other side, multihoming on one side reduces the need for multihoming on the other side, because access to the subscribers on the other side is guaranteed anyway.[184] That is, if users multihome, develop-

182. *See* Nicholas Economides, *The Economics of the Internet Backbone*, *in* HANDBOOK OF TELECOMMUNICATIONS ECONOMICS 373, 383–85 (Sumit K. Majumdar et al. eds., 2006). Competition is analogous to the degree of overlap between the networks subscribers multihome too. *See* Alexander Rasch, *Platform Competition with Partial Multihoming Under Differentiation*, 12 ECON. BULL. 1, 1–2 (2007).

183. Choi, *supra* note 181, at 607-10; *see also* Economides, *supra* note 182.

184. This holds under the assumption that exclusive subscribers (end users or developers) to a network are more valuable than subscribers who multihome. *See* Attila Ambrus et al., *Either or Both Competition: A "Two-sided" Theory of Advertising with Overlapping Viewerships* (Working Paper), http://ftp.zew.de/pub/zew-docs/veranstaltungen/ICT2012/Papers/Reisinger_Ambrus_Calvano.pdf. Roson also concludes that multihoming on one side reduces the incentives to multihome on the other side. *See* Roberto Roson, *Platform Competition with Endogenous Multihoming* (So. Sci. Res. Network Electronic Paper Collection, Working Paper), http://ssrn.com/abstract=657901.

ers can switch from an exclusionary system to a non-exclusionary one, and they will still be able to reach all users. This creates incentives for the exclusionary system to refrain from this practice for fear of driving away developers.

There is no doubt that multihoming is neither a perfect alternative to fully unobstructed competition nor a guarantee that every combination of inputs and platforms will be possible, a result that could be obtained by the complete banning of exclusion. Multihoming potentially imposes a cost to subscribers (that of joining more than one systems),[185] and it can reduce welfare as well as competition under certain conditions.[186]

But as a matter of actual practice, and therefore as a matter of generating actual results in how consumers access products and services and in how manufacturers make products and services available to consumers, one should notice its growing popularity. ComScore reports that the majority of users multihome in several regards of their digital life, including modalities of accessing the internet (desktop, smartphone, tablet), services they use (including social media, e-commerce, and messaging services), media sources and media outlets, and others.[187] At the same time, most of the modern mobile communication devices support both licensed and unlicensed spectrum connectivity, doubling the channels through which consumers can access services and applications.[188] There is considerable evidence that the wireless future will be dominated by smart or cognitive radios, which allow devices to switch seamlessly between different bands of the spectrum—e.g. cellular,

185. Toker Doganoglu & Julian Wright, *Multihoming and Compatibility*, 24 INT'L. J. INDUS. ORG. 45, 47 (2006); Jean J. Gabszewicz & Xavier Y. Wauthy, *Two-Sided Markets and Price Competition with Multi-homing*, at 2, http://ssrn.com/abstract=975897; Sujit Chakravorti & Roberto Roson, *Platform Competition in Two-Sided Markets: The Case of Payment Networks* 24 (Fed. Res. Bank of Chi., Working Paper No. 2004-09). The cost does not have to be monetary. For example, when the FCC was scrutinizing the AOL – Time Warner merger, they were considering mandating that AOL Messenger be interoperable with other messengers, because AOL's argument that users can simply install and use more than one messengers (i.e. the cost of multihoming to multiple messengers) was deemed to be too burdensome for users. *See* In the Matter of Applications for Consent to the Transfer of Control of Licenses and Section 214 Authorizations by Time Warner Inc. and America Online, Inc., Transferors, to AOL Time Warner Inc., Transferee, FCC 01-12, ¶¶ 153-174 (Memorandum Opinion and Order) (2000).

186. It can reduce competition because subscribers buy more than once and so systems don't compete for exclusivity. For the same reason it can also reduce compatibility incentives. Lack of competition can sustain prices at higher levels, and lack of compatibility can be welfare reducing when compatibility is desirable, i.e. when network effects are strong and the cost of achieving compatibility is low. *See* Doganoglu, *supra* note 185, *passim*.

187. COMSCORE, CROSS-PLATFORM FUTURE IN FOCUS 2016, *passim* (2016).

188. Travis E. Litman, *Cognitive Radio: Moving Toward a Workable Framework for Commercial Leasing of Public Safety Spectrum*, 4 J. TELECOMM. HIGH TECH. LAW 249, 259–61 (2005).

Wi-Fi, WiMAX—and can represent different connectivity systems to which users can subscribe.[189]

Other market players multihome as well. For example, many manufacturers produce devices that run both Android and Windows Phone OS (and sometimes even alternative operating systems like Ubuntu Phone). In the Android ecosystem in particular, there are also multiple Android application platforms on top of the official Google Play (e.g. Amazon's AppStore) and Android also supports installations from "unsupported" sources (e.g. a direct link from a website), which give yet another option for service and application developers to reach end users.

The effect of multihoming in all of these situations is that end users and/or product and service developers can find multiple ways of connecting in the marketplace. As these paths connecting products and services to consumers multiply, the bottleneck power of each such path is weakened.

B. *Interconnection and Compatibility*

Multihoming as discussed previously represents a vertical relationship between actors in different levels of the value chain, and it demonstrates how the ability of a subscriber in one level to connect to multiple systems at another level limits the power of each individual system and makes exclusion less effective in the presence of other alternatives.

Instead of subscribers connecting to multiple systems, a similar effect can be achieved horizontally by having systems in the same level connect to each other so that there is more than one path to reach a system. Several words are used to describe this arrangement but it is most commonly known as interconnection: the physical and logical connection between two actors/elements in a network for the purpose of exchanging traffic.[190] Interconnection technically presupposes that network elements "speak" the same language, otherwise they won't be able to communicate. The use of mutually agreed protocols that enable two different systems to communicate with

189. *See, e.g.*, MICHAEL CALABRESE ET AL., REPORT FROM THE SPECTRUM INVENTORY WORKING GROUP OF THE COMMERCE SPECTRUM MANAGEMENT ADVISORY COMMITTEE 4 (2010) (NTIA's advisory panel opinion stating that "the communications industry is beginning the implementation of a new generation of cellular technology that incorporates smart antennas, Internet protocol, and other new techniques for content compression. Over the next 10 to 20 years, these new technologies will effectively multiply existing cellular-communications spectrum allocations by at least an additional 10 times."); s*ee also* Brad J. Bernthal et al., *Trends and Precedents Favoring a Regulatory Embrace of Smart Radio Technologies*, 2ND IEEE INT'L SYMP. ON NEW FRONTIERS IN DYNAMIC SPECTRUM ACCESS NETWORKS 633 (2007).

190. *See* 47 C.F.R. § 51.5; EU Directive 2002/19/EC on Access to, and Interconnection of, Electronic Communications Networks and Associated Facilities, Art. 2(b); ITU, *NGN Interconnection and Access*, GSR Discussion Paper, at 5 (2007); Daniel Spulber & Christopher Yoo, *Network Regulation: The Many Faces of Access*, 1 J. COMPETITION LAW ECON. 635, 641 (2005); Gerald Faulhaber, *Access (Does not Equal) Access (1) + Access (2)*, 2002 MICH. ST. DCL LAW REV. 677, 686 (2002).

each other makes them *compatible*,[191] and lack of compatibility is tantamount to exclusion.[192]

What interconnection and compatibility do is multiply the links between systems (and between actors within systems) and, thereby, open up more paths through which end users can access services and applications.[193] As actors across systems become more interconnected with each other, the ability of each individual actor to affect how traffic flows decreases, because the availability of alternative paths through which data can be detoured undermines, much like multihoming, the power and effectiveness of bottlenecks and exclusionary behavior.[194] In fact, as Werbach has noted "interconnection, as a safety valve for routing around platform bottlenecks, is the best mechanism to tame anticompetitive behavior in such an environment."[195]

Common knowledge, for example, suggests that one of the main reasons why the internet is considered to be so resilient and also hard to regulate end to end is that it consists of several interconnected autonomous systems that are intricately linked to each other, so that if one of them fails or refuses to accept traffic, traffic can be routed around it to its destination.[196] As a general matter then, extensive interconnection and compatibility transform a purely vertical value chain into a "diagonal" ecosystem. If, for instance, network A blocks traffic that comes directly from source B, but is in a peering agreement with network C, which stipulates that A must accept all traffic from C (this is, by definition, the nature of peering agreements), then traffic from B can be rerouted through C to reach A's subscribers.[197]

The question now is whether interconnection and compatibility are dependable options in terms of their natural occurrence, that is whether industry dynamics do or will transition from a mere theoretical technical availability of interconnection and compatibility to actual implementation without the need for regulatory interference.

The prevailing line of thought suggests that as long as there are a few players of comparable size in the market, it is in their interest to interconnect and to achieve compatibility between their services.[198] The rationale is that,

191. Joseph Farrell & Timothy Simcoe, *Four Paths to Compatibility*, *in* OXFORD HANDBOOK OF DIGITAL ECONOMY 34, 34–38 (Martin Peitz & Joel Waldfogel eds., 2012).

192. Nicholas Economides & Lawrence J. White, *Networks and Compatibility: Implications for Antitrust*, 38 EUR. ECON. REV. 651, 655 (1994) ("the decision to produce and sell a component that is incompatible with potentially complementary components is tantamount to exclusion.").

193. *See*, *e.g.*, David Gilo, *A Market-Based Approach to Telecom Interconnection*, 77 S. CAL. L. REV. 1, 6–7 (2003).

194. Kevin Werbach, *Only Connect*, 22 BERKELEY TECH. L. J. 1233, 1294–97 (2007).

195. *Id.* at 1297.

196. Spulber and Yoo, *supra* note 190, at 64 (making a similar point for secondary peering).

197. *Cf.* Werbach, *supra* note 194, at 1294–95.

198. Jacques Cremer, Patrick Rey & Jean Tirole, *Connectivity in the Commercial Internet*, 48 J. IND. ECON. 433 *passim* (2000) ("Degradation is more likely the larger the differ-

with networks of roughly similar size, none of them can unilaterally dominate the market through incompatibility or lack of interconnection, but, to the contrary, they can exploit stronger network effects if they combine their networks.[199] It would take a rather dominant player in the market—and there is some disagreement as to the exact market share required—to make exclusion of other networks a profitable strategy.[200]

Additionally, the observation that a dominant player blocks interconnection and compatibility with smaller rivals is not in itself enough to prove ability to harm smaller rivals without knowing their competitive strategy. For example, Malueg and Schwartz develop a model where competition between the excluded smaller rivals serves as a promise for higher quality to consumers and makes them more appealing than the larger network.[201] It is also known that the size of the network is not the only factor that weighs in in consumer choices; their expectations from the network as well as how well the network complements their existing choices and investments are also important.[202]

Further, even in the presence of a dominant player, refusal to interconnect or achieve compatibility does not inexorably result in anticompetitive effects. Ostensibly, a dominant player would want to block interconnection and compatibility to exclude the subscribers of the smaller networks and deprive them of positive network externalities with the ultimate goal to lure them into his own network. However, several factors need to be in place for subscribers to switch to another (even bigger) network: network effects must

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ence in installed bases."); Michael Katz & Carl Shapiro, *Network Externalities, Competition and Compatibility*, 75 AM. ECON. REV. 424, 425 (1985) ("[F]irms with good reputations or large existing networks will tend to be against compatibility, even when welfare is increased by the move to compatibility. In contrast, firms with small networks or weak reputations will tend to favor product compatibility. . .").

199. *See* Interconnection and Resale Obligations Pertaining to Commercial Mobile Radio Services, 155 FCC Rcd. 15975, ¶ 24 (Third Report and Order) (2000). *See also* Automatic and Manual Roaming Obligations Pertaining to Commercial Mobile Radio Services, 15 FCC Rcd. 21628, ¶ 32 (Notice of Proposed Rulemaking) (2000).

200. *See* David Malueg & Marius Schwartz, *Interconnection Incentives of a Large Network*, 38 (Georgetown Uni. Dep't of Econ. Working Paper 1.05 (2001) ("Overall our analysis indicates that, for [given] parameter values. . . global degradation is unlikely to be profitable unless the largest network controls substantially more than half the installed-base customers. Regarding targeted degradation, we found that it is profitable in [Cremer, Ray, Tirole's] example only for a small set of parameter values.").

201. *Id*. at 32 ("The logic is that a larger number of (Cournot) rivals implies stronger competition among them, which—for suitable consumer expectations—leads to more new subscribers being added and a concomitant increase in the relative quality of the rivals' network. Indeed, for some parameter values, if the largest network pursued global degradation then the only possible equilibrium would be tipping to the rivals. Competition among the rivals serves as a commitment to consumers that the rivals' network will expand more aggressively than would a single firm (for the same initial base), and this competition-based advantage of the rivals' network can overcome the disadvantage of its smaller installed base.").

202. Michael Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 J. ECON. PERSPECT. 93 *passim* (1994).

be strong, switching costs must be low, coordination between the smaller players must also be low,[203] and subscribers must be unable or unwilling to internalize the positive externality that they will create for the network they join (excess momentum),[204] or the negative externality for the network they leave (excess inertia).[205] Given these factors it is entirely possible that subscribers of smaller networks do not want or do not need to switch to the larger network, and therefore the larger network's exclusionary policies are less effective, causing an actor considering exclusion to steer away from it.

Moreover, a feature of interconnection and compatibility is that, to achieve redundancy in the market, not all actors have to be connected to all other actors. If network A interconnects with network B but not C, and C interconnects with B, subscribers of network C can still reach subscribers of network A (*mutatis mutandis* for compatibility). In that scenario, C may not be in the position to strike a direct interconnection agreement with A, but the desired effect can be achieved with B's intermediation. Such indirect interconnection or compatibility may come with an additional cost, economic or technical, but this is not an issue that lends itself to ex ante regulation.

What the above analysis shows is first, that interconnection can be an effective mechanism by which the power of each individual node in a network to serve as bottleneck is reduced, and second, that for interconnection to break down to a point that actors are effectively excluded, a series of market conditions must be in place. However, an important question remains, which is whether the conditions described above are easy or hard to encounter in digital markets. If they are hard to find, then interconnection as a bypass/redundancy mechanism will be less relevant in the analysis of exclusion; if, on the other hand, market forces and technological possibilities result in a robust interconnection matrix, then interconnection can be relied on with less need for regulatory or antitrust coercion. This is something to be examined separately in every market, but there are indications that important aspects of digital markets are becoming more interconnected. These mainly relate to the underlying networks that support digital markets.

The main two reasons why the underlying network infrastructure is becoming more robustly interconnected is because the hierarchical structure of the early IP interconnection model is being supplanted by secondary peering,[206] and because the generalized transition to IP multiplies the links

203. Faulhaber, *supra* note 190, at 689–99 (where the author discusses the conditions that need to be present for anticompetitive behavior to arise. A dominant firm will opt to not interconnect if (a) it is substantially larger than its competitors, (b) there are strong network effects, (c) switching costs are low, (d) smaller players don't interconnect among themselves).

204. *See* Michael Katz & Carl Shapiro, *Product Introduction with Network Externalities*, 40 J. IND. ECON. 55, 55–56 (1992).

205. *See* Joseph Farrell & Garth Saloner, *Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation*, 76 AM. ECON. REV. 940, 940–41 (1986).

206. SPULBER & YOO, *supra* note 8, at 55–69.

among providers. Both result in more links created in the network, and therefore less bottleneck power concentrated in the hands of each link.

Take, for example, data interconnection in the new wireless environment. Mobile carriers traditionally exchange traffic by virtue of negotiated agreements between them, but this is not the only way. If these direct agreements break down, operators can interconnect through the internet with or without the use of an intermediary, but they also increasingly interconnect through the so called IPX interconnection (IP eXchange), which is a collection of managed networks (IPX providers) that carry IP traffic globally among wireless operators.[207] IPX has many unique characteristics (e.g. assured QoS, cascading payments), which make it a popular and valuable market proposition.[208] In effect, IPX creates an additional layer of interconnection, which in fact has many advantages over direct or internet-mediated interconnection.[209] Because IPX is open to anyone who wants to participate, there are many IPX providers and there is competition among them. Under these circumstances, refusal of an operator to directly interconnect through traditional means with another operator does not result in the latter operator being effectively excluded from the communication matrix, or even from the domain of the operator who refused direct interconnection.

Further, considering that TDM service and interconnection is being phased out in favor of IP interconnection, the fact that operators have many options to choose from diminishes the emergence of real bottlenecks. And this, unlike TDM interconnection, does not only apply to voice service, but essentially to any type of service, application, or content, since all traffic is IP traffic in next generation networks. Consequently, to the extent that the links between two points (nodes) in a network multiply, it becomes harder for each of them to acquire enough power to engage in anticompetitive exclusion. The market, instead, provides other routes to bypass it.

It is true that this may not always be the case. For instance, termination monopoly still poses a problem, because for every modality of network access, there is no route-around at the termination level.[210] But even in this

207. In fact, there are additional variations of IP interconnection. *See* INTERNATIONAL INTERCONNECT FORUM FOR SERVICES OVER IP, OVERVIEW OF NETWORK ACCESS TYPES FOR A MULTISERVICE IP INTERCONNECTION (Release 1.1) (2012); *See*, *e.g.*, Renjish K.R. Kumar, *International Mobile Data Roaming: Managed or Unmanaged?*, in 9TH IEEE CONFERENCE ON TELECOMM. INTERNET AND MEDIA TECHNO-ECONOMICS (CTTE) 1, 1–2 (2010).

208. GSM Association, Inter-Service Provider IP Backbone Guidelines 5.0, Official Document IR 34 (2011).

209. John Baldwin et al., *Evolution of the Voice Interconnection*, 88 ERICSSON REV. 10 (2010). *See also* Natalija Gelvanovska, *Coexistence of Traditional and IP Interconnection* (Int'l Telecom. Union, Global Symposium for Regulators Discussion Paper, 2009), at 14-17.

210. *See* European Regulators Group, ERG Common Statement on Regulatory Principles of IP-IC/NGN Core, ERG (08) 26 Final NGN IP-IC CS 081016, at 78 (2008) (ERG (now BEREC) explains that "though this [:IP] ubiquitous connectivity in principle has the potential of breaking the termination monopoly for voice calls, the control functions on the service layer generally will prevent such procedure. VoIP calls are set up using higher-level protocols, e.g.

case, the emergence of alternative ways of interconnection in other parts can still be helpful. There is a difference in the negotiation power vis-a-vis termination between a large operator and individual small operators (which is where the power of termination monopoly is expected to be exercised), and a large operator and an IPX provider who represents the aggregate traffic of a multitude of smaller (and/or larger) operators. In the latter case, even small players can get a better deal through the collective bargaining power they can amass. Therefore, the suggestion here is not that new options for interconnection will eliminate the ability to exclude, but that they increase and enhance the bypassing mechanisms, thus making aggregation of power harder.

IV. Durability of Power

The previous part on ability to exclude discussed the conditions that determine how easy or hard it is for firms to amass the necessary market power to effectively exclude rivals from the market. But, even if firms succeed in positioning themselves in a way to be able to engage in exclusionary conduct, adopting preventive or suppressive measures is not warranted unless the exclusionary conduct can persist in time.[211] This is for two reasons: first, because regulatory, judicial, or antitrust measures are quasi-irreversible, whose effect extends into the future, and therefore should be forward looking and reflect expected future conditions.[212] Starting from the assumption of free self-correcting markets, intervention is warranted when the markets' self-correcting mechanism has been given enough time to generate results, and it has failed.[213] In its stead, regulatory or antitrust intervention will artificially create the desirable conditions. However, because these measures do not expire and are not recalled (sunset clauses are rare, and changes in regulatory and antitrust policy are infrequent), the conditions they will create are semi-permanent until they are rendered irrelevant by market forces (or a policy change). Therefore, one should make sure that they are indeed needed to replace what the market should have taken care of itself.

SIP, that provide a translation from an individual customer's E.164 number or Internet-style "user name" to an actual IP address that is needed for a call to be terminated. As this IP address is only known by the customer's VoIP provider, the termination monopoly is set to remain also in the NGN world as the called party's VoIP provider is still needed to terminate a call, even though only with regard to signaling matters.").

211. For how this requirement has been integrated as a requirement in regulatory and antitrust analysis *see supra* Part 2.2.2.

212. Coates, *supra* note 15, at 10.

213. *See, e.g.*, Commission Recommendation of 9.10.2014 on Relevant Product and Service Markets Within the Electronic Communications Sector Susceptible to Ex Ante Regulation in Accordance With Directive 2002/21/EC of the European Parliament and of the Council on a Common Regulatory Framework for Electronic Communications Networks and Services, 7-9 (Commission lists the relevant criteria to identify markets susceptible to ex ante regulations: a) presence of high and non-transitory barriers to entry, b) whether a market structure *tends towards effective competition within a relevant time horizon*, c) the application of competition law alone would not adequately address the market failure(s) concerned.).

Second, such measures come with a cost and therefore their use should justify the cost of intervention. The cost of regulation and antitrust enforcement has been extensively analyzed; it includes among others the cost of maintaining a regulatory or enforcement authority, the cost of monitoring implementation of measures, and the cost of market complexity and dissuasion.[214] As a result, if the ability to exclude is simply transitory, regulatory or judicial measures might prove premature and unnecessarily burdensome.

This simple insight suggests that, in markets where the conditions conducive to anticompetitive exclusion are harder to persist, regulatory and antitrust action might be less likely to be necessary. In fact, even if proxies of market power, like supra-competitive profits, persist, one should still ensure that there is an anticompetitive cause behind it, and therefore perhaps an antitrust solution.[215] Digital markets are generally thought to be fast-paced, and have been theorized to be less suitable for heavy-handed regulatory or antitrust measures.[216] This is in no way to say that they should be exempt from regulation or antitrust action,[217] but that perhaps the nature of the industry is such that evidence of market power treated in isolation of the dynamic evolution of the industry is weaker proof of market failure that regulatory and antitrust authorities may need to address, compared to other industries, where the buildup and maintenance of anticompetitive power is easier.[218]

This argument on the role of the durability of market power has been made repeatedly in the literature with regard to digital markets, but it does not seem to have fully convinced authorities and courts.[219] This can be either

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214. See VISCUSI, HARRINGTON, AND VERNON, *supra* note 43, at 39–48; Michael K Block & Joseph Gregory Sidak, *The Cost of Antitrust Deterrence: Why Not Hang a Price Fixer Now and Then*, 68 GEO. LAW J. 1131 (1979); Wayne B. Gray, *The Cost of Regulation: OSHA, EPA and the Productivity Slowdown*, 77 AM. ECON. REV. 998 (1987).

215. *See* Carl Shapiro, *Antitrust in a Time of Populism*, Int'l J. of Indus. Org. (forthcoming), http://faculty.haas.berkeley.edu/shapiro/antitrustpopulism.pdf.

216. Teece & Coleman, *supra* note 8, at 843–46; Lawrence Sullivan, *Is Competition Policy Possible in High Tech Market?: An Inquiry Into Antitrust, Intellectual Property, and Broadband Regulation as Applied to "The New Economy,"* 52 CASE WESTERN RESERVE L. REV. 41, 43–44 (2001); Lopatka & Page, *supra* note 8; Schmalensee, *supra* note 8.

217. Even the most progressive of antitrust scholars agree that dominance and market distortions are a possibility that cannot be ignored and for that reason antitrust and market supervision still has a place and time. *See, e.g.,* Pitofsky, *supra* note 7, at 133. Rubinfeld, *supra* note 7.

218. David Evans & Richard Schmalensee, *Some Economic Aspects of Antitrust Analysis in Dynamically Competitive Industries*, in 2 INNOVATION POLICY AND THE ECONOMY 18–20 (Adam B. Jaffe, Josh Lerner, & Scott Stern eds., 2002) (concluding that "a proper market-power inquiry in new-economy industries must include a serious analysis of the vigor of dynamic competition. This requires looking beyond current sales figures." *Id.* at 20).

219. *See e.g.*, ANTITRUST MODERNIZATION COMMISSION, REPORT AND RECOMMENDATIONS, at 9 (2007) ("There is no need to revise the antitrust laws to apply different rules to industries in which innovation, intellectual property, and technological change are central features."); Alexander Italianer, Prepared Remarks on Level-playing Field and Innovation in

because it is simply a false argument, meaning that it has been properly articulated and yet rejected, or because the value of the argument has not been proved or appreciated sufficiently.

Considering the stance of regulatory and antitrust authorities, one should be happy to put the argument to rest if we trust their judgement. But there is empirical literature, which has remained unaccounted for in the circles of legal scholarship and case law, that informs the debate otherwise. The empirical literature does not suggest that high technology markets are so competitive as to obviate the need for oversight, but it does provide support for the position that they are more competitive compared to other industries, based on a number of metrics. This conclusion, to the extent that it is true, should feed into the analysis of exclusion: the higher the competitive intensity, the less sustainable is market power that can give rise to anticompetitive exclusion. What this part attempts to do is discuss the argument on the volatility of market power in high technology markets, and to refine it to better reflect the realities of such markets.

A. *Why Are Digital Markets Thought to Be Highly Competitive?*

A number of explanations have been offered in support of the idea that digital markets are less conducive to the buildup of the necessary market power and conditions that would allow long-term exclusionary practices to occur, the kind that can harm the competitive process (rather than individual competitors—if that).

For one thing, the heightened competitive supply and demand conditions as described previously in Sections 3 and 4 support the proposition that effective long-term exclusion is harder to achieve in digital markets. But various other explanations have already been offered. For instance, one of the main thrusts behind digital markets' dynamism may be that they are characterized by network effects.[220] Network effects help firms gain market power faster than if network effects were not present, but since this also goes for the their competitors, network effects can eventually result in the firms' own demise.[221] As a result, players in network industries enjoy fast growth,

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Technology Markets, Conference on Antitrust in Tech. (Jan. 28, 2013) ("Allegedly, the constant and rapid pace of technological innovation would make entrenched positions of market power impossible to maintain. Well, if there are such characteristics present in a market, we will fully acknowledge them in our cases, like we did in a recent merger case involving mobile payments. But we do not think that 'high-tech' markets—however their boundaries may be defined—should be generally immune from antitrust intervention."); Maureen K. Ohlhausen, Prepared Remarks at Free State Found.'s Sixth Annual Telecomm. Policy Conference (Mar. 18, 2014).

220. *See, e.g.,* Nicholas Economides, *The Economics of Networks*, 14 INT. J. IND. ORGAN. 673, 675–99 (1996); Economides, *supra* note 40.

221. *See* Nicholas Economides & Charles Himmelberg, *Critical Mass and Network Evolution in Telecommunications*, *in* TOWARD A COMPETITIVE TELECOMMUNICATIONS INDUSTRY 58 (Gerald Brock ed., 1995); David Easley & Jon Kleinberg, NETWORKS, CROWDS, AND

but upon emergence of a competing wave of network effects, they also face *rapid displacement*, making any market position precarious and, along with it, practices that rely on that position.[222]

Further, sectoral surveys over the past twenty years suggest that traditional sources of advantage such as economies of scale, advertising, distribution systems, and R&D, albeit still important, can sometimes be trumped by such features of technology-intensive industries as lower barriers to entry, more frequent technological change, ease of switching on the side of consumers, the dominant role of intellectual property and high rates of patenting and cross-licensing.[223] These developments increase mobility in the market and allow only temporary advantage until competitors catch up with or outmaneuver aggressors.[224] In no small part because of technological interdependence, vehement standard competition and continuous experimentation are considered staple characteristics of high technology industries.[225]

It has also been noted that technology-intensive industries present greater product differentiation and are in a better position to address niche audiences and more specialized consumer needs.[226] The larger scope of available solutions leads to higher "internal" competition, faster obsolescence and ultimately to new waves of innovation.[227] Lucrative niche markets can then serve as the source of funding for the new waves of innovation.[228]

Moreover, because, in highly technical industries, human capital and know-how often form a large part of the innovation cost, disruptive innovations that affect business models and organizational paradigms are easier to bring to the market compared to innovations that require primarily capital-

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MARKETS 479 et seq. (2010); Joseph Farrell & Paul Klemperer, *Coordination and Lock-In: Competition with Switching Costs and Network Effects*, *in* HANDBOOK OF INDUSTRIAL ORGANIZATION VOLUME III 1974 (Mark Armstrong & Robert Porter eds., 2007).

222. *See* Sangin Park, *Quantitative Analysis of Network Externalities in Competing Technologies: The VCR Case*, 86 REV. ECON. STAT. 937 (2004) (where the author examines how network effects helped the VCR standard overtake the Betamax standard).

223. *See, e.g.*, Richard D'Aveni, HYPERCOMPETITION: MANAGING THE DYNAMICS OF STRATEGIC MANEUVERING (1994); Evans & Schmalensee, *supra* note 17; Lacy Glenn Thomas, *The Two Faces of Competition: Dynamic Resourcefulness and The Hypercompetitive Shift*, 7 ORGAN. SCI. 221 (1996); Haim Mendelson & Ravindran R. Pillai, *Industry Clockspeed: Measurement and Operational Implications*, 1 MANUF. SERV. OPER. MGMT. 1 (1999). *See also* Guy Gellatly & Valerie Peters, *Understanding the Innovation Process: Innovation in Dynamic Service Industries*, STATISTICS CANADA, ANALYTICAL STUDIES BRANCH RESEARCH PAPER SERIES No. 127, 20 (1990).

224. Bala Chakravarthy, *A New Strategy Framework for Coping with Turbulence*, 38 SLOAN MGMT. REV. 67 (1997).

225. Greenstein, *supra* note 169, at 46–63.

226. Alok K. Chakrabarti & Eric H. Kessler, *Innovation Speed: A Conceptual Model of Context, Antecedents, and Outcomes*, 21 ACAD. MGMT. REV. 1143, 1156–57 (1996).

227. Morton I Kamien & Nancy L Schwartz, MARKET STRUCTURE AND INNOVATION 9–11 (1982); Ross Brennan, *Evolutionary Economics and the Markets-as-Networks Approach*, 35 IND. MARK. MGMT. 829, 831–32 (2006).

228. Chakrabarti & Kessler, *supra* note 226.

intensive investments.[229] In such an environment, market leaders may have a hard time maintaining their dominance against rivals.[230]

B. *Incorporating Empirical Evidence*

The above-mentioned theories all sound plausible, but they have been known for a while to regulatory and antitrust authorities and have only had limited influence. It is perhaps helpful to notice, however, that there is empirical literature that sheds light on the matter, which has been ignored so far, and that, if incorporated, can provide a more complete picture. This is the purpose of this part.

A few perambulatory comments are due before proceeding to the empirical evidence. First, the available empirical literature does not always have as an exclusive focus high technology or digital industries. Many (but not all) of the studies look into potential shifts of the competitive dynamics of multiple industries in general, some focus on the manufacturing sector and some on high technology industries in particular. In any case, the studies that survey multiple industries based on general datasets also cover high technology industries and, in that sense, they are still relevant.

Second, the available data on which these studies were based stops in the early 2000s. As a result, much of the internet and mobile revolutions are not reflected in the results of these studies. However, the theoretical factors underpinning hypercompetition (*see supra 5.1)* seem to apply with even greater vigor in the post-millennium digital environment, and so one can extrapolate from the available studies. It is acknowledged however that this data gap should raise the level of cautiousness the results are approached with.

Third, while it is tempting to believe that these studies actually prove or disprove hypercompetition, one should pause to think what hypercompetition and competitiveness mean in this context; in other words what it means to say that digital markets are more competitive than other markets, or that digital markets today are more competitive than in the past. The preferred proxy for measuring competitiveness and the one thought to exhibit the closest association with it is profit margins, since they show how much more a firm can charge above the (perfectly) competitive price.[231] The problem with profit margins is that they are hard to measure even at the firm level, let alone the industry level. Moreover, and as expected, there is not always a good correlation between profit margins and competitiveness. For example, Apple famously operates with large profit margins but it is doubtful how

229. *See* Mehmet Yorukoglu & Thomas F. Cooley, *Innovation and Imitation in an Information Age*, 1 J. Eur. Econ. Assoc. 406, 407 (2003).

230. Walter J. Ferrier, Ken G. Smith & Curtis M. Grimm, *The Role of Competitive Action in Market Share Erosion and Industry Dethronement: A Study of Industry Leaders and Challengers*, 42 Acad. Mgmt. J. 372 (1999).

231. *See* Sullivan, Grimes, & Sagers, *supra* note 31, at 109-10.

well this translates into its competitive position in the market given its far from dominant market share (customer loyalty, reputational and Veblen effect factors, and other behavioral economics insights may be in a better position to explain such observations).

Other proxies include mortality rates (intense competition makes firm survival more difficult), market shares and sales (intense competition makes maintenance of market shares and sales more difficult), return on assets (intense competition drives down profitability relative to assets), and stock market value (intense competition makes stock value volatile). All these variables are linked to how easy or hard it is to maintain a competitive advantage, but none of them individually or all of them taken together can capture the full picture of the competitive pressure in the market. In other words, these studies show *correlation*, but it may be impossible to show *causation*. That said, the variables used are the best approximation of competition we have, and even assuming that the evidence is not perfect, it would be unwise to ignore it. In fact, one can argue that if studies that rely on different metrics for competition reach the same conclusion, then the conclusion is more robust. That is to say, if one study deduces hypercompetition from an increase in profit volatility, and another study deduces hypercompetition from increased entry and mortality, then it seems that the conclusion is corroborated on more than one ground.

A short summary of the studies now follows (results are summarized in Table 2). In its general form *hypercompetition* was popularized by D'Aveni in his book *Hypercompetition*,[232] where he claimed that four factors (growing consumer demands, technology, falling entry barriers, easier access to capital) contributed in the last decades to creating such market conditions that rapidly generate new competitive advantages with the effect of neutralizing the competitive advantages, leaving the industry in constant disequilibrium and disarray.[233] D'Aveni's claim cuts across several industries, including high technology industries, and provides anecdotal evidence in support of using multiple variables. A number of subsequent studies on multiple industries supported D'Aveni's hypothesis. A more analytically rigorous study by Thomas followed two years later, focusing on the manufacturing sector sampled between 1958-1991 using stock market value as the relevant variable, and found a hypercompetitive shift.[234] A subsequent study by Thomas and D'Aveni used profits as the relevant variable and found increased profit volatility in the manufacturing sector between 1950 and 2002.[235] Wiggins and Ruefli, using a dataset of more than 40 industries

232. D'Aveni, *supra* note 223.

233. Richard A. D'Aveni, *Waking up to the New Era of Hypercompetition*, 21 WASH. Q. 183 (1998).

234. Thomas, *supra* note 223.

235. L G Thomas & Richard D'Aveni, *The Changing Nature of Competition in the US Manufacturing Sector, 1950—2002*, 7 STRATEGIC. ORG. 387 (2009).

between 1972 and 1997, and return on assets and Tobin's q as variables, confirmed that competitive advantage is harder to sustain across both low and high technology industries.[236]

Another set of studies found targeted support for high technology industries. Mendelson and Pillai developed the idea that IT industries operate on a more dynamic *clockspeed* basis, using a combined index of three elements over a sample of companies between 1992 and 1994: the fraction of total revenue derived from new products, the total duration of product innovation, and the rate of decline in the prices of input materials.[237] Vaaler and McNamara surveyed high and very high technology industries (which they determine on the basis of R&D intensity) using multiple variables like market shares, and mortality rates, and found support for very high technology firms, but not for high technology firms.[238] Castrogiovanni found, based on a sample of manufacturing firms between 1967 and 1992 and using multiple variables including sales, profits, and employment rates, that new industries (defined as those that first appear in the SIC system in 1972 compared to 1967) exhibit higher dynamism that old ones.[239] Foster and Kaplan surveyed multiple industries using various metrics like profits and mortality rates, and found that high technology industries exhibit increased competitiveness rates in waves; that is, there are periods of hypercompetition but not a steady shift towards more competitive conditions.[240]

A few more specialized studies also seem to support hypercompetition. Lee et al. studied the effect of complementarity among computer programs and showed that, in the years between 1990 and 2002, software complementarities among products increased, which in turn heightened exposure and volatility. As a result, they found that market shares in the software industry were more difficult to maintain. Brown and Goolsbee studied the effect of online competition in the insurance market between 1992 and 1997 and found that online presence caused prices to fall by 8–15%. This was read to imply that online competition increases competition in general (within the boundaries of the market).

There was only one study that found no support for hypercompetition. McNamara et al. surveyed multiple industries on the basis of multiple variants, including return on assets and mortality rates, and concluded that the

236. Robert R Wiggins & Timothy W Ruefli, *Schumpeter's Ghost: Is Hypercompetition Making the Best of Times Shorter?*, 26 Strategic Mgmt. J. 887 (2005).

237. Mendelson & Pillai, *supra* note 223.

238. Paul M Vaaler & Gerry McNamara, *Are Technology-Intensive Industries More Dynamically Competitive? No and Yes*, 21 Org. Sci. 271 (2010).

239. Gary J. Castrogiovanni, *Organization Task Environments: Have They Changed Fundamentally Over Time?*, 28 J. Mgmt. 129 (2002).

240. Richard Foster & Sarah Kaplan, Creative Destruction: Why Companies That Are Built to Last Underperform the Market—And How to Success fully Transform Them (2011).

only hypercompetitive era was between 1985 and 1988.[241] They pointed out that there does not seem to be a shift towards more competition in general, but without saying that there are not periods during which, for whatever reason, competitive intensity is higher. Assumingly, this also means that one should aim to be aware of which of these periods might be occurring and adjust policy-making accordingly as these periods unfold. Their results seem hard to reconcile with the rest of the literature, but they can be attributable mainly to the use of different variables, the particular methodology applied, and the different cohorts of firms that studies used, even if they relied on the same datasets.

Study	Industry	Dates	Metric	Hyper/c	Comments
D' Aveni, 1994	Multiple	- 1992	Multiple	Y	Anecdotal evidence.
Thomas, 1996	Manufacturing	1958-91	Stock market value	Y	Hypercompetitive shift.
Mendelson & Pillai	IT industries	1992-94	Multiple (revenue, product innovation rate, price of input material)	Y	IT industries operate at higher clock-speed.
Brown & Goolsbee, 2000	Insurance	1992-97	Price	Y	Prices fell by 8-15% because of online competition.
Foster & Kaplan, 2001	Multiple	1962-98	Multiple (profits, exit etc.)	Y/N	High-tech industries exhibit hypercompetition in waves
Castrogiovanni, 2002	Manufacturing	1967-92	Multiple (sales, profits, employment)	Y/N	New industries exhibit higher dynamism (change in environmental elements)
McNamara et al., 2003	Multiple	1978-97	Multiple (ROA, exit etc.)	N	Only hyper-competitive era was 1985-88.
Wiggins & Ruefli, 2005	Multiple	1972-97	ROA, Tobin's q	Y	Competitive advantage is harder to sustain. Hypercompetition confirmed across both low and high-tech industries.
Thomas & D' Aveni, 2009	Manufacturing	1950-02	Profits	Y	Steady increase in profit volatility.
Vaaler & McNamara, 2010	High tech & very high tech	1978-97	Multiple (returns, market share, exit)	Y/N	Validation only for very high-tech firms.
Lee et al., 2010	Software	1990-02	Market share	Y	Complementarity among products increases hypercompetition (market instability).

TABLE 2: EVIDENCE OF HYPERCOMPETITION IN HIGH TECH MARKETS. DARK GREEN INDICATES STRONG EVIDENCE, LIGHT GREEN INDICATES WEAK EVIDENCE, RED INDICATES NO EVIDENCE.

241. *See* Vaaler & McNamara, *supra* note 238, at 286.

The overall impression from these studies seems to be that, at least as regards high technology industries, and under the qualifications offered previously, competitive advantage is harder to maintain compared to other industries, and/or that competitive advantage is harder to maintain now compared to decades ago. This does not and should not be read to mean that antitrust and regulation in high technology industries are obsolete. However, going back to the principle that regulation and competition enforcement are warranted only if the market imperfection they seek to rectify will reasonably persist in time—otherwise one should wish to forego the cost of regulation or enforcement and let the market self-correct—the results presented here suggest that an elevated measure of proof is required to answer that condition in the affirmative.

The antitrust action against the exclusionary practices in the Microsoft and IBM cases exemplify well this point. Microsoft, having been found to engage in exclusionary behavior in the browser market (through tying/integration of Internet Explorer to Windows), was forced to implement measures to give consumers greater choice in said market (e.g. by prompting consumers to choose their preferred browser).[242] However, Microsoft's already rapidly declining presence and its eventual irrelevance in that market, unrelated to the imposed measures,[243] shows that, in markets where competition is on the rise, regulatory and antitrust enforcement can more easily prove superfluous. The Microsoft case is often mentioned in conjunction with the famous IBM antitrust case that was initiated by the US government in 1969, on the grounds of abuse of market power, and eventually dropped 13 years later with the government realizing that the market conditions were vastly different from when the case was initiated.[244] Such cases can serve as valuable cautionary reminders about the appropriate treatment of hypercompetitive industries.

C. *Refinements*

One thing the above studies do not capture is the evolutionary state of the industry during which competitiveness is measured. The analysis showed some support for the idea that a large number of industries, including high technology industries, are becoming more competitive in general, or, in the

242. Peter Sayer, *EU Accepts Microsoft's Commitments to Offer Browser Choice*, MACWORLD (Dec. 16, 2009), https://www.macworld.com/article/1145120/microsoft_eu_browser.html.

243. The declining market shares of Firefox and Opera, which were offered as Tier 1 alternatives in the selection screen, but also the global, rather than EU-specific, consistency of browser adoption trends, show that the measure did not achieve its purpose.

244. John Lopatka, *United States v. IBM: A Monument to Arrogance*, 68 ANTITRUST L. J. 145, 161-62 (2000); Edward T. Pound, *Why Baxter Dropped the I.B.M. Suit*, N.Y. TIMES (Jan. 9, 1982), http://www.nytimes.com/1982/01/09/business/why-baxter-dropped-the-ibm-suit.html.

alternative, that regardless of general competitiveness trends, high technology industries are inherently more competitive than other industries. While this conclusion is useful in itself, it is also true that the competitive conditions within industries change as they evolve, and the permanence and importance of any potential competitive advantage changes accordingly too. Assumingly, both the anticompetitive implications of exclusion as business strategy, and the appropriate response will differ depending on whether the industry under scrutiny is in its infancy, maturity, or decline, regardless of its inherent or comparative competitiveness. This proposition is explored below.

There is not a single way to look at industry evolution. Some industries follow well-studied patterns, while others are more unpredictable and less well-understood. While this ambiguity presents analytical difficulties, as regulators, authorities, and courts must identify which pattern—if any—fits which market, what can be said with certainty is that it would be unwise for these institutions to forego an attempt to incorporate an evolutionary analysis into their reasoning for intervention. Failing to do so risks untimely or unwarranted intervention.

The mainstream description of industry evolution is found in the *product life cycle theory*, which introduced the now familiar S-curve to describe how products and markets mature.[245] It distinguishes between four stages: introduction, growth, maturity and decline.[246] In the introduction stage the product develops its main qualities and characteristics, and innovation rates are high, as is risk; in the growth stage quality improves and consumer demand grows; in the maturity stage the product acquires its main characteristics, differentiation drops and market saturation occurs; and in the decline stage competition thins out, margins contract, and product development slows down.[247]

Abernathy, Utterback and Dosi, in a similar classification, divide evolution in two phases, the *pre-paradigmatic* and the *paradigmatic*.[248] The pre-

245. For a graphical summary of different curves of product life cycles *see* David R. Rink & John E. Swan, *Product Life Cycle Research: A Literature Review*, 7 J. BUS. RES. 219, 221–23 (1979); William E. Cox, *Product Life Cycles as Marketing Models*, 40 J. BUS. 375, 382 (1967). *See also* Joel Dean, *Pricing Policies for New Products*, HARVARD BUS. REV. (1967), https://hbr.org/1976/11/pricing-policies-for-new-products. The PLC theory is applicable to both individual products and markets. S*ee* Yoram Wind, *A Note on the Operationalization of the Product Life Cycle Concept*, WHARTON 3-4 (1975), https://marketing.wharton.upenn.edu/files/?whdmsaction*id.*=public:main.file&fileID=1884.

246. *See* PORTER, *supra* note 93, at 158; PHILIP KOTLER & KEVIN LANE KELLER, MARKETING MANAGEMENT 571–74, 590 (13th ed. 2008).

247. *See* PORTER, *supra* note 93, at 159–61.

248. *See* James M. Utterback & William J. Abernathy, *A Dynamic Model of Process and Product Innovation*, 3 OMEGA INT'L. J. MGMT. SCI. 639 (1975); Giovanni Dosi, *Sources, Procedures, and Microeconomic Effects of Innovation*, 26 J. ECON. LITERATURE 1120 (1988); Michael L Tushman & Philip Anderson, *Technological Discontinuities and Organizational Environments*, 31 ADMIN. SCI. Q. 439, 441 (1986); Scott Gallagher & Seung Ho Park, *Innova-*

paradigmatic phase roughly corresponds to the introduction stage of the product life cycle theory, and is characterized by fluidity in design, high uncertainty, innovation and experimentation, small market size and low demand.[249] Once a *dominant design* emerges, the market moves to the paradigmatic phase, which sees increasing standardization around the dominant design and market expansion, much like the growth and maturity stages of the product life cycle theory predicts.[250]

Although the number of stages in these theories fluctuates,[251] there is a clear evolutionary path common to both of them: initially, new products, services, and markets go through a flux stage during which they acquire the main characteristics that will define their form throughout their life cycle; then, they enter the phase where details in the design are filled in, the product or service takes its most representative form and the market expands around it.[252] Until markets stabilize at or after this stage, both potentially (anti)competitive dynamics and the response to them should be analyzed with extreme caution.

In particular, in the introduction stage perceived anticompetitive exclusionary effects can well be transitory and misleading. Young product and service markets are highly experimental and fluid,[253] there is constant redesign and adaptation to match market feedback, which itself is rudimentary,[254] and the inherent potentials of innovation are unclear and so are consumer demand and needs.[255] Accordingly, exclusionary practices can be part of the experimentation to get the initial design right, and any market power that builds up during this phase and enables potentially anticompetitive exclusion is contingent upon the success of the proposed design, something that neither the firm nor regulators or courts are in the position to know. During this phase, the innovator should be let alone "[to] be intimately coupled to

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tion and Competition in Standard-based Industries: A Historical Analysis of the US Home Video Game Market, 49 IEEE TRANSACTIONS ON ENGINEERING MGMT. 67 (2002). *See generally* Devendra Sahal, PATTERNS OF TECHNOLOGICAL INNOVATION (1981).

249. Utterback & Abernathy, *supra* note 248, at 643.

250. *Id.* at 644–46.

251. There are many other variations on top of those presented here. *See, e.g.,* Rink & Swan, *supra* note 245, at 222; Chester Wasson, DYNAMIC COMPETITIVE STRATEGY AND PRODUCT LIFE CYCLES 3–10 (1974); Utterback & Abernathy, *supra* note 248, at 641–45.

252. *See* Dosi, *supra* note 248, at 1159–63; Fernando F. Suarez, *Battles for Technological Dominance: An Integrative Framework*, 33 RES. POL'Y 271, 271 (2004); James M. Utterback & Fernando F. Suarez, *Innovation, Competition, and Industry Structure*, 22 RES. POL'Y 1, 5–7 (1993).

253. *Cf.* Donald K. Clifford, Jr., *Leverage in the Product Life Cycle*, 85 DUN'S REV. & MODERN INDUS. 62 (1965).

254. PORTER, *supra* note 93, at 159–61.

255. Trevor J. Pinch & Wiebe E. Bijker, *The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other*, 14 SOC. STUD. SCI. 399, 421-24 (1984).

the market,"[256] which involves picking the right partners and, as a logical inference, excluding those that are deemed inappropriate or threatening.

Even as the market grows in later stages, exclusionary effects enabled by the competitive advantage of having come up with or adopted the dominant design can still be volatile. There is still uncertainty around how competitive the market will become, what the intensity and effect of entry is, and ultimately, whether the market will be able to constrain anticompetitive effects on its own. It is only until the maturity phase, when the market stabilizes, that one can make a relatively safe assessment as to the effect of exclusion and the benefits of regulatory or antitrust measures. It may seem that this is too narrow a window for appropriate regulatory or antitrust action, but the truth is that, in the PLC stream of theories, the maturity stage is the one that lasts the longest, and so there are still plenty of engagement opportunities for antitrust and regulatory authorities. PLC's implication for antitrust and regulatory action is with regard to picking the appropriate timing.

What complicates the task of identifying appropriate timing is that not all markets follow the structured path PLC suggests. There are specific examples of industries that diverge either because of their different order of evolutionary phases, or because their evolution was heavily influenced by demand-side factors, something that the PLC streams assign marginal value to.[257] More specifically, to digital markets, what complicates the definition of evolutionary phases, and the pinpointing of transition points from one phase to another, is the protean nature of the products and services in these markets.

Digital markets often comprise large technical systems (LTS), namely large "coherent structures comprised of interacting, interconnected components," or complex products and systems (CoPS), a similar type that is characterized by a large number of specialized components and subsystems that are usually hierarchically organized and that present a high degree of engineering intensity and technological novelty. We can collectively call them large complex systems.[258] Large complex systems often exhibit continuous interactions and recombinability among their components which can leave them in a constant state of flux, thereby preventing them from reaching a paradigmatic stage where basic properties have solidified.[259] This is by no

256. David J Teece, *Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy*, 15 RES. POL'Y 285, 290–91 (1986).

257. Steven Klepper, *Entry, Exit, Growth, and Innovation over the Product Life Cycle*, AM. ECON. REV. 562, 563 (1996).

258. Mike Hobday, *Product Complexity, Innovation and Industrial Organization*, 26 RES. POL'Y 689, 691–92 (1998); Andrew Davies, *The Life Cycle of a Complex Product System*, 1 INT'L. J. INNOVATION. MGMT. 229, 230–32 (1997). *See also* Ying-Tao Ren & Khim-Teck Yeo, *Research Challenges on Complex Product Systems (CoPS) Innovation*, 23 J. CHINESE INST. INDUS. ENGINEERS 519, 521–23 (2006).

259. Davies, *supra* note 258, at 233-38; Hobday, *supra* note 258, at 700-01.

means always the case (aircraft engines are an example of CoPS that has acquired a final form as a project), but it is more common in large complex systems that do not develop under the management of a single authority. In that sense, the contribution of unaffiliated third parties makes them more open, decentralized, and susceptible to unpredictable disruptions and innovations that shape them and the market around them.

Markets that are structured around platforms, which is very common in the digital environment, may also evolve less linearly than the PLC stream of theories suggests. This is because of the separation between the platform itself and its inputs/components, and the feedback loop that arises between the two.[260] The bidirectional relationship between platform and complements can change the boundaries, nature, and purpose of the platform, and by extension the market around it.[261]

In this context, the assessment of anticompetitiveness can be tricky. To take social networks for example, the service has evolved from being a simple online profile, to providing a platform for applications, payment functionality, integration with third-party websites, messaging functionality, credentials management functionality, etc. To the extent the market never really stabilizes, it is hard to make an accurate assessment of competitive conditions, the effects of exclusionary practices, and also the effectiveness of regulatory and antitrust action.[262] Admittedly, not all platforms exhibit this kind of feedback loop with their environment.[263] But the argument still stands: even if one is able to identify, attribute, and punish anticompetitive exclusionary policies of a platform firm, imposing behavioral (or structural) remedies, either by means of antitrust enforcement or regulatory measures, would be an exercise in futility, if the nature of the firm and market are bound to change soon thereafter.

V. Anticompetitive Conduct

As mentioned previously, it is not enough to demonstrate that an exclusionary practice is capable of anticompetitive effects (considering supply and demand conditions), or that these effects are likely to persist in time so that intervention is needed to fill in for the gap the market's own coping mechanisms leave. It must further be shown that the behavior under scrutiny

260. Thomas R. Eisenmann, *Managing Proprietary and Shared Platforms: A Life-Cycle View*, HBS Working Paper 07-105, at 2 (2007). *See also* Eisenmann et al., *Opening Platforms: How, When and Why?*, (Harvard Bus. School, Working Paper 2008), *passim*.

261. Amrit Tiwana, Benn Konsynski & Ashley A Bush, *Research Commentary—Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics*, 21 Info. Sys. Res. 675 (2010).

262. *Cf.* the antitrust cases against MySpace and Facebook, LiveUniverse, Inc. v. MySpace, Inc., 304 F. App'x 554 (9th Cir. 2008); Facebook, Inc. v. Power Ventures, Inc., No. C 08-5780 JW, 2010 WL 3291750 (N.D. Cal. July 20, 2010).

263. Llewellyn D W Thomas, Erkko Autio & David M Gann, *Architectural Leverage: Putting Platforms in Context*, 28 Acad. Mgmt. Perspectives 198, 199–205 (2014).

is the result of *abuse* ("bad conduct") of a firm's position and market power, because otherwise we would be condemning firms simply for acquiring or possessing (even persistent) market power by lawful means.[264]

While the abuse element is mostly associated with antitrust, regulatory theory also requires a showing of market failure, rather than simply suboptimal market structure. At least as regards the prevention of exclusionary conduct (as opposed, e.g., to price regulation or welfare redistribution rationales for regulation), regulators intervene when they conclude that market players have the ability and incentive to use their market power to shut out competition,[265] not simply if market players have market power, since it is conceivable that concentrated markets can be the natural and/or most efficient state of the market if large market shares and power have been acquired lawfully.[266] In a way, it is recognized that the mere possession of market power is not an offense. It is rather the combination of market power and anticompetitive conduct that antitrust law seeks to avert, and it is the artificial maintenance of sub-competitive conditions that regulation seeks to avert.

By maintaining this important distinction, antitrust and regulatory policy ensure, on the one hand, that firms have the incentive to compete aggressively and reap the benefits of their success, and, on the other hand, that any competitive advantage is the result of business acumen and not of harmful conduct. As Justice Scalia has stated:

> "[t]he mere possession of monopoly power, and the concomitant charging of monopoly prices, is not only not unlawful; it is an important element of the free-market system. The opportunity to charge monopoly prices—at least for a short period—is what attracts "business acumen" in the first place; it induces risk taking that produces innovation and economic growth. To safeguard the incentive to innovate, the possession of monopoly power will not be found unlawful unless it is accompanied by an element of anticompetitive *conduct*." (emphasis in original).[267]

The difficult question here is what is defined as acceptable competitive behavior and what as abusive. Like with every legal concept, there is some

264. HOVENKAMP, *supra* note 29, at 296–97. *See also Grinnell*, 86 S.Ct. at 570–71.

265. Cento Veljanovski, *Economic Approaches to Regulation*, in THE OXFORD HANDBOOK OF REGULATION 17, 20–23 (Robert Baldwin, Martin Cave, & Martin Lodge eds., 2010). *See also*, *e.g.*, the justification for the Open Internet regulations by the FCC *in* Open Internet Order, *supra* note 23, ¶¶ 75-103 (2015) ("The record on remand continues to convince us that broadband providers—including mobile broadband providers—have the incentives and the ability to engage in practices that pose a threat to Internet openness, and as such, rules to protect the open nature of the Internet remain necessary. Today we take steps to ensure that the substantial benefits of Internet openness continue to be realized.").

266. CHRISTOPHER DECKER, MODERN ECONOMIC REGULATION 18–19 (2014).

267. *Verizon*, 540 U.S. at 407.

definitional uncertainty. The Supreme Court has ruled that antitrust laws are not meant to apply "against conduct which is competitive, even severely so, but against conduct which *unfairly* tends to destroy competition itself,"[268] (emphasis added). Unlawful conduct is that which is "directed at smothering competition."[269] In the same vein, the Court of Justice of the European Union only outlaws "[business] methods different from those governing *normal* competition in products or services," which have "the effect of hindering the maintenance of the degree of competition still existing in the market or the growth of that competition" (emphasis added).[270] In other words, antitrust law seeks to protect competition "*on the merits*," no matter how aggressive.[271] Regulatory practice works in the same direction; it takes action to promote rather than stifle competition on the merits. As the European Commission has put it "the objective of any ex ante regulatory intervention is ultimately to produce benefits for end-users by making retail markets competitive on a sustainable basis."[272]

The possible justifications that support a conclusion of competition on the merits as opposed to conduct that tends to unfairly destroy competition itself, are, of course, specific to each case. So, for example, exclusive agreements, which have been traditionally looked at with great suspicion, can be deemed acceptable if they are of short duration, and come with procompetitive justifications like supporting a business plan that requires a guaranteed line of supply. But what I want to suggest in this part is that, in digital markets in particular, there are additional justifications underlying exclusionary practices, which are specific to the nature of digital markets, and which can reveal their meritorious nature and therefore render them acceptable. These justifications relate to the nature of digital markets and the dynamics of competition in such markets.

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268. Spectrum Sports, Inc. v. McQuillan, 506 U.S. 447, 458 (1993).

269. Berkey Photo, Inc. v. Eastman Kodak Co., 603 F.2d 263, 275 (2d Cir. 1979).

270. Case 85/76 Hoffmann-La Roche & Co. AG v Commission of the European Communities, EU:C:1979:36, para. 91.

271. *See* Ball Memorial Hospital, Inc. v. Mutual Hospital Insurance, Inc., 784 F.2d 1325, 1338 (7th Cir. 1986) ("injuries to rivals are byproducts of vigorous competition" and therefore "to deter aggressive conduct is to deter competition."). In *Irish Sugar* the Court of Justice noted that "an undertaking in a dominant position cannot have recourse to means other than those within the scope of competition on the merits," an idea expressed also in *AKZO*, where the Commission accepted that firms are "entitled to compete on the merits." Case T-228/97 Irish Sugar v Commission, EU: T:1999:246, ¶ 111. *See also* Case C-457/10 P AstraZeneca v Commission, EU:C:2012:770, ¶ 75.

272. Commission Recommendation 2007/879/EC, Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a Common Regulatory Framework for Electronic Communications Networks and Services, 2007 O.J. (L 344/65).

A. *Locking-in as the New Monopolist's Reward*

One of the common business practices in digital markets is to give away combinations of products and services. Firms routinely tie products together, integrate functionalities, impose full-line requirements, or otherwise provide favorable treatment to their own products and services to the exclusion of competitors. Consider for example Android, which in most versions comes together with a bundle of other Google applications like Gmail and Google Play. Rivals have complained that the tying of Android with Google's applications, and the bundling of Google's applications together, creates an unfair competitive advantage for Google, which in turn makes competition on the merits harder or impossible for them.

It is easy to see the case against Google here: Google uses its market power in the mobile operating systems market to promote its other services and products, which can result in the exclusion of rival services and products.[273] But if Google acquired its market power through lawful means, and if it cannot exercise (by exercise I do not mean abuse) that market power through the usual route of the pricing mechanism, since its products and services are mostly free, to reap the benefits of its success, should it still be banned from exercising market power through different means?

In traditional markets, where prices are a key metric of success, common economic thinking suggests that if a monopolist acquires a dominant position through business acumen, then the monopoly rents they can reap once in that position are their reward for outperforming competitors and should not be taken away from them.[274] It is not the purpose of antitrust or regulation to artificially keep prices low, if their high level is the result of normal competition or the natural propensity of the market.[275] To the contrary, industrial policy rewards innovators and good performers through a variety of means, for instance granting temporary monopolies (e.g., patents and copyrights),[276] being more lenient on research and development schemes that would otherwise raise collusion concerns,[277] or tolerating high prices that are the result of a firm's (lawful) prevailing strategy in the market.[278]

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273. *See, e.g. supra* note 25 (noting the fears the European Commission expressed in European Commission Press Release IP/15/4780).

274. *See Verizon*, 540 U.S. at 407 ("The opportunity to charge monopoly prices—at least for a short period—is what attracts "business acumen" in the first place."). *See also* Philippe Aghion et al., *Competition and Innovation: an Inverted-U Relationship*, 120 Q. J. ECON. 701 (2005) (discussing the relationship between competition, profits, and innovation); Kamien & Schwartz, *supra* note 227 at 24–31.

275. *See Berkey Photo*, 603 F.2d at 291; *accord* Kartell v. Blue Shield, 749 F.2d 922 (1st Cir. 1984).

276. *See, e.g.*, Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, 2 INNOVATION POL'Y & ECON. 51 (2002).

277. *See* JONATHAN FAULL & ALI NIKPAY, FAULL AND NIKPAY: THE EU LAW OF COMPETITION ¶ 7.143-7.234 (3rd ed. 2014).

278. *See supra* note 272.

But when the pricing mechanism is missing, because products and services are offered for free, a substitute reward in lieu of rents must be found, otherwise one risks upsetting the incentivizing mechanism of free markets. Exploitation of the complementarities between a firm's products and services, and even lock-in effects of covering multiple consumer needs in different markets by urging and facilitating them to use products and services of the same firm, can fill that gap.[279] Technology-driven platform markets, in particular, are often criticized for initially providing a no-strings-attached environment for services and applications to grow, and then engaging in exclusionary acts to promote their own products and services when the ecosystem has established its position in the market. While this appears anticompetitive (and it can be), it is worth noting that it is often difficult for technology-driven platform actors to know when and where along the value chain they will be able to generate revenue, and therefore, a shift in strategy using the leverage of whatever market power they have amassed in a given layer may be necessary to maintain the incentive of joining the value chain in the first place. While it is often assumed that as long as a firm generates value by offering its products, it will also appropriate that value, the link between doing business (i.e. providing products and services), and generating revenue is not always clear. As Teece has elaborately explained, value appropriation is far from automatic, and it often requires firms to exercise control in various parts of the value chain to prevent value generated by their products and services being appropriated by other firms in the value chain.[280]

One could argue that advertising revenue can help appropriate the value generated by free products and services, but not all free products and services come with advertisements.[281] Affiliated products and services, however, might, and this is what builds the case for the joint promotion of these products and services to the exclusion of others. Similarly, the joint promotion of products and services by the same firm can nurture the creation and adoption of an ecosystem in which the value generated by one component of the ecosystem can subsidize another, which by itself is not capable of gener-

279. Christoph Zott & Raphael Amit, *Business Model Design: An Activity System Perspective*, 43 Long Range Plan. 216, 221–22 (2010) (where the authors discuss the NICE design theme on value generation: Novelty, Lock-In, Complementarities, Efficiency. They provide Apple as an example: "A prominent example is Apple, which used to be focused on the production of innovative hardware such as personal computers. Through the development of the iPod and the associated music download business iTunes, Apple was the first electronics company that included music distribution as an activity (content novelty), linking it to the development of the iPod hardware and software (structure novelty), and digitizing it and thereby pushing many subactivities of legal music downloads to its customers (governance novelty). That is, Apple expanded the locus of its innovation from the product to its business model.").

280. *See* Teece, *supra* note 256, at 292.

281. Alexander Osterwalder & Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers 92–101 (2010).

ating revenue (perhaps because it is not separately or sufficiently valued by consumers).

Under the circumstances, another way of looking at exclusionary practices is as the dominant firm's means of appropriating the value it generates while succeeding in the market. The ability to exercise that privilege is what motivates the firm to succeed in the first place (much like monopoly rents). Under this light, what can pass as normal, on the merits competition changes: if dominance has been attained meritoriously, if the dominant firm cannot play the pricing game, and if effective competition is not fully destroyed, then expanding the concept of normal competition to include such potentially exclusionary acts as tying, discrimination, full-line forcing, etc., would be a step in the direction of reflecting the special competitive dynamics and strategies in digital platform markets, where products and services are commonly traded for free and where externalities between products and services of the same firm allow firms to offer greater variety to consumers.

This conclusion is not a free pass for firms to engage in potentially anticompetitive acts. The conditions set above are not necessarily easy to satisfy. But it may be easy to overlook what normal competition is in digital markets by simply looking at how one traditionally understands normal competition.

B. *Rapid Experimentation and the Need for Risk Management*

As mentioned in Part 3, a number of factors that characterize digital markets contribute to increased mobility and inter-market expansion (e.g., technological proximity, flexible locus of functionality, vertical pressure, and multistakeholderism). The effect identified above was that under the circumstances of increased mobility and expansion, exclusion is less likely to generate anticompetitive effects because it is easier for competitors to supply the market with what the excluding firm attempts to deprive it of.

The same characteristics also give rise to a different effect, which relates to firms' business models in digital markets and by extension to what can be considered normal competition in such markets. Heightened mobility and inter-market expansion also means that firms tend to attempt entry and be present in multiple markets. This increases opportunities, as well as risk and exposure. Much like in any other market situation, firms in digital markets do not and cannot know in advance which markets they will succeed in, but in digital markets—for the reasons explained above—it is easier to try. The enhanced conditions of experimentation create a concomitant heightened need for risk management.

One way to minimize risk is for firms to create ties between their various products and services, so that risk is dispersed among them, and the

success of one can support the suboptimal performance of others.[282] Bundling and joint promotion also help with adoption and risk management on the demand side, as consumers are also hesitant to adopt new products, especially in high-technology markets.[283]

Importantly, because, as explained in Part 3.1, the boundaries of digital markets are malleable, because the power flow between players in different but complementary markets changes often, and because the architectural shape of products and services in digital markets is protean, the achievement of a measure of success in a given market provides less assurance of a stable competitive advantage. These conditions make it more justifiable, if not imperative, to engage in practices that tie the potential success in one market to another.

Indeed, as Table 3 shows, five of the most active digital firms (Amazon, Apple, Facebook, Google, Microsoft) are today present in multiple markets, to which they expanded rapidly and successively, allowing them to jointly promote their products, often to the exclusion of competitors from their ecosystem. A number of interesting observations can be made about how these companies compete.

First, the speed of entry into multiple markets is astonishing, with companies entering new markets every few years. Staying ahead of competition, when the norm is expanding into new markets within such short timeframes, can mean that there is little time to calculate risk and business opportunities. In turn, this suggests that under the circumstances, an own-product favoritism approach can be expected as a counter-measure.

Second, while these five firms all started from a different market originally, today they exhibit a significant overlap in activities; it is obvious from the table that they have all expanded into each other's line of business. One explanation is that, because systems competition is prevalent in digital markets, firms are pressured to enter adjacent markets and promote their products as bundles for fear that, if a rival firm dominates one component of the system, dominance can easily spill over to the rest of the system as well, thereby quickly marginalizing rival firms in multiple markets (this concern is related to the leveraging theory). This is regardless of their respective originating market. A firm that remains absent from one of those component markets or keeps it separate from the rest of its products and services is therefore a firm at a disadvantage. Because it remains unknown which component will become most valuable, firms have an incentive to enter as many

282. Gary D. Eppen, Ward A. Hanson & Martin Kipp, *Bundling - New Products, New Markets, Low Risk*, 32 MIT SLOAN MGMT. REV. 7, 8–11 (1991) (where the authors discuss the different ways by which bundling can help a company lower costs, limit risk, expand into new markets, and become more efficient).

283. Shikhar Sarin, Trina Sego & Nataporn Chanvarasuth, *Strategic Use of Bundling for Reducing Consumers' Perceived Risk Associated with the Purchase of New High-Tech Products*, 11 J. MKTG. THEORY PRAC. 71 (2003).

	Amazon	Apple	Facebook	Google	Microsoft
Advertising platform	• (2002)		• (2009/2012)	• (2003)	• (2006)
AI assistant app	• (2015)	• (2014)	• (2017)	• (2016)	• (2014)
AI assistant devices	• (2015)			• (2016)	
AI infrastructure	• (2015)			• (2015)	
App store	• (2011)	• (2008)	• (2007)	• (2008)	• (2009/2010)
Browser	• (2011)	• (2003)		• (2008)	• (1995)
Cloud services (businesses)	• (2006)			• (2011)	• (2010)
Cloud services (consumers)	• (2011)	• (2011)		• (2012)	• (2007)
Computer accessories		• (1977)	• (2016)	• (2014)	• (1982)
Content distribution	• (1998/2007)	• (2001)		• (2006/2011)	• (1996)
E-commerce	• (1994)		• (2007)		
Maps		• (2012)		• (2005)	• (2010)
Messaging/chat		• (2011)	• (2011)	• (2005)	• (1996/1999)
Office tools		• (1979)		• (2006)	• (1983)
OS (Desktop)		• (1978/1984)		• (2011)	• (1981/1985)
OS (Mobile)	• (2012)	• (2007)		• (2008)	• (2010)
Payment services		• (2014)	• (2015)	• (2011)	
PC		• (1978)			
Physical retail	• (2015)	• (2001)			• (2009)
Search (general)				• (1997)	• (1998/2005)
Search (specialized)	• (1994/2002)		• (2013)	• (2002)	• (2009)
Smartphones	• (2014)	• (2007)		• (2010/2016)	• (2010)
Social networks			• (2004)	• (2010)	
Tablets	• (2011)	• (2010)		• (2012/2016)	• (2012)

TABLE 3 (BASED ON TABLE 1): MARKETS IN WHICH AAFGM ARE PRESENT, DATES OF ENTRY, ORIGINATING MARKET (IN LIGHT GREY), MAIN PROFIT SOURCE TODAY (DARK GREY).

markets as possible compared to their competitors and spread risk among them by tying them together to the exclusion of rival components. This way, they will have gained some foothold in multiple markets in case one or more of them prove decisive.

For example, Amazon Echo and Google Home both combine an AI app engine and the physical device and both integrate with the companies' respective content and other services but not with each other's. The strategy here is to build an AI ecosystem around each firm's products and services to the exclusion of those of the rival firm, rather than give users the ability to mix and match. This is reasonable. Amazon and Google entered the AI app and AI devices market about the same time, and it is uncertain whether consumers will value more the AI app component and abilities or the AI device features (e.g., its ability to integrate with other services, quality of hardware, additional features, etc.). Bundling the two components relieves firms from taking separate risks and rewards them for their cumulative effort in innovation.

Third, the markets these firms originated in are not the markets that drive most of their profits today (in Table 3 above, light grey is originating market, dark grey is most profitable market). For example, Amazon started as an e-commerce service, but it is its cloud and virtual infrastructure services that drive most of its profits today. Similarly, Apple started as a personal computer manufacturer, but the main profit source today is the iPhone line, and Microsoft started as an operating system company, but it is mostly its productivity tools and cloud and infrastructure services that drive profits. With high rates of innovation, rapid creation and expansion of markets, and shifting consumer preferences, profitability in digital markets is volatile. Because ensuring a stable source of revenue is challenging, and because digital markets are characterized by a strong pressure toward free or freemium business models, it makes sense for firms to create dependencies between their products and services so that cross-subsidies absorb the risk of entry and expansion.[284]

The above justifications are clearly not applicable in every business context, and they can be overridden by other considerations. But what is important to take away from this section is that the concept of normal on the merits competition is one that has to be determined in the context of the industry under scrutiny, and to do that one needs to take into account the business models that seem to be driving industry practice and evolution.

VI. Conclusion

The preceding analysis brought together two key elements of digital markets: the business practice of exclusion and the role of technology in informing its antitrust and regulatory treatment. While a lot has been written on regulation and antitrust policy in technology-intensive markets, the majority of that work is concerned with the "new economy" aspects of those markets, whereas the technological aspects have received patchy attention. I attempted to extend and enrich the ways by which technological aspects of digital markets affect the analysis of exclusion, to bring them under a unified framework of analysis, and to introduce scholarship from technology, management, and economics studies that has so far remained underused in or absent from the legal and policy debates.

The general direction observed is that, as regards the technology factor in digital markets, exclusionary behavior becomes less likely to distort competition, because of the effect of the structural preconditions of anticompetitive exclusion: the demand and supply conditions in the market must be such that accord firms the ability to foreclose a significant line of commerce; the exclusionary practice and its results must be able to persist for a potent

284. *See, e.g.*, Kent Walker, *Android: Choice at Every Turn*, Google: The Keyword (Nov. 10, 2016), https://blog.google/topics/google-europe/android-choice-competition-response-europe.

amount of time as to justify intervention; the exclusionary practice should not constitute normal on the merits competition.

What was attempted to be shown respectively is that the technology-intensive nature of the industry creates more sources of competition and more ways to bypass bottlenecks, making effective exclusion harder; that the competitive advantage which accords the necessary power to engage in anticompetitive exclusion may be harder to maintain; and that some exclusionary practices that appear anticompetitive can in fact be normal and expected ways for firms to compete in digital markets. Taken together, these considerations will provide courts and authorities an adapted framework by which to understand exclusion in digital markets.