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Taking Ecosystems Competition Seriously in the Digital Economy– Note by Nicolas Petit and David J. Teece

Hearing on Competition Economics of Digital Ecosystems

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If you have questions about this document please contact
Mr Harry HONG [Email:Harry.HONG@oecd.org]
Mrs Ania THIEMANN [Email:Ania.THIEMANN@oecd.org]

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Taking Ecosystems Competition Seriously in the Digital Economy: A (Preliminary) Dynamic Competition/Capabilities Perspective

By Nicolas Petit* and David J. Teece**

1. Introduction

1. The rise of ecosystems characterizes the history of the modern business organization. Some thirty years ago, economist James Moore wrote in a seminal paper "*competition among business ecosystems is fueling today's industrial transformation*" (Moore, 1993). To illustrate his point, Moore singled out retailing, entertainment, and pharmaceuticals.

2. In the intervening decades, new opportunities arising from digital technologies led innovative entrepreneurs to design ecosystems to make market entry, drive value creation and capture, and support new product and process development. Ecosystems became the organizational method of choice to do business. Today, it seems almost too trite to mention that ecosystems are ubiquitous in digital industries (Teece, 2018). Microsoft, Apple, Google, Netflix, Amazon, and Facebook are household ecosystems names.

3. The important facts about ecosystems are well set out in the literature. By contrast, the topic of competition between ecosystems is one about which little is known. To be sure, the main streams of research have produced many concepts, analytical frameworks and insights on the competitive dynamics of business ecosystems (Tsujimoto et al, 2018). But the ecosystems competition literature remains invertebrate. To date, no clear, complete, and predictable theory of competition between business ecosystems has been formulated. This is all the more true in respect of digital ecosystems, where the role of data complicates the situation somewhat.

4. The proper assessment of competition and competitive dynamics is important in a policy context. Governments committed to rely on objective, scientific and facts-based knowledge need to take account all ecologies of competition in the formulation and implementation of antitrust, competitiveness and regulatory policies.

5. And the issue is of some moment. Responsive to the political context, policymakers at all levels of government are tempted to sharpen their knives against digital ecosystems. Drawing on main line models and theories steeped in the static, equilibrium-based, structural frameworks of neoclassical economics, the emerging policy predictably tends to (usually incorrectly) ascribe monopoly explanations to the growth, diversification and robustness of digital ecosystems.

6. In this short note, we accept the essential significance of the ecosystem concept, and the ecology of competition that goes with it. This leads us to claim that "product market" centric monopoly, gatekeeping or incumbency explanations provide narrow descriptions of the determinants of business ecosystems survival and failure. The infirmity that threatens policy formulation can be understood with a metaphor. Everyone understands

* European University Institute, Florence.

** Institute for Business Innovation, U.C. Berkeley, and Berkeley Research Group Institute

that a theory of football competition that purports to explain outcomes and does so by looking only at the end score or at the 90' of the game is incomplete. It leaves aside substantial elements of the competitive process that happen in the locker room, at training sessions, during negotiations with agents, players, and sponsors.[1] And it also ignores previous games or the possibility of doping or corruption.

7. In our view, dynamic capabilities or lack thereof, provides the missing picture. This is especially relevant in the digital economy. Each digital ecosystem surely looks "*alone in [its] field*" (Schumpeter, 1942). But many are subject to broad-spectrum competition, pressure from complements, and deep uncertainty. In digital industries, the rewards to dynamic capabilities are higher… and the penalties for weak dynamic capabilities are severe.

8. Do not misread us. We are not supporting a repudiation of mainstream economic models. We believe that many principles inherited from neoclassical models deserve to keep a place in the policy-making toolbox. But we seek to encourage policy makers to take ecosystems competition, and the underlying grammar of dynamic capabilities, seriously.

9. To that end, this short note recalls the common properties of business ecosystems (1) and the idiosyncrasies of digital ecosystems (2). It then describes how dynamic capabilities provide a good understanding of ecosystems competition (3). It closes by describing how a dynamic capabilities-minded antitrust policy would look like (4).

2. The Five "Cs" of Business Ecosystems

10. Ecosystems are networks of business entities that work together to create and capture value. Ecosystems are hard to define because they are dynamic organizations whose boundaries and strategies are fluid. A digital ecosystem is typically reliant on the technological leadership of one or more firms that provide a "*platform*" around which other system members called "*complementors*", ie supply chain actors providing inputs and complementary goods, align their investments and strategies. Five concepts characterize the concept of business ecosystem. We call them the five "Cs" of ecosystems.

2.1. Cross business, market and industry competition.

11. The single most important factor about ecosystems is that platforms and complementors are "*not a member of a single industry*", but participate in broad-spectrum competition that "*crosses a variety of industry*". In ecosystems, competition occurs at three levels (Teece, 2018):

1. between one platform and another, as was the case between Apple and Tandy for the computer market in the late 1970s, or the current case of Apple's iOS versus Google's Android in the mobile sector;
2. between a platform and its complementors, as occurred with Microsoft capturing a part of the value from browsers, streaming media, and instant messaging applications that worked on its Windows operating system; and

[1] Note though that we are not saying that a theory needs to explain everything to be relevant. See for a short discussion of the issue, /https://blog.oup.com/2020/03/scientific-facts-are-not-100-certain-so-what/

3. among complementors, each seeking a dominant position within an ecosystem, as in the case of Spotify, Deezer, Tidal or Apple Music each chasing the same consumer segment".

12. Separately, each level of competition amongst business ecosystems can of course be looked at as a fight for market share. However, these "competitive struggles" do not operate independently. They jointly determine the growth or failure of ecosystems (Moore, 1993). One of us has referred to this interdependence in terms of "moligopoly" competition (Petit, 2020).

2.2. Co-evolution

13. Evolutionary elements play a primary role in a business ecosystem (Arnd and Norbert, 2015). Like biological ecosystems, business ecosystems go through periods of competitive strength and weaknesses (Teece, 2018), from loosely organized coalitions to more structured networks (Moore, 1993), from strategies of value creation to value capture (Tsujimoto et al., 2018), and from challenges of launch to problems of growth (Cennamo, 2018). In his seminal paper, Moore described the "lifecycle" of an ecosystem as a succession of four phases consisting of "birth, expansion, leadership and self-renewal" (or "death").

14. Now, this evolutionary property does not, in itself, make business ecosystems any different from the "firm" as a meaningful unit of analysis of industrial organization. What really matters is this: the process of ecosystem change is one of *co*-evolution driven by the reciprocal interaction of "heterogeneous ecosystems members". This reciprocal cycle leads to generativity, meaning "new output, structure, or behavior" (Wareham, Fox and Giner, 2014). In the best-case scenario, co evolution creates entirely new services, industries or general purpose/enabling. This is what happened when interactions with merchants led Amazon to develop Amazon Web Services ("AWS"), now Amazon's main moneymaking segment. Initially designed as a set of APIs, AWS incrementally morphed into a complete infrastructure, compute, storage, and database service for developers. In the worst-case scenario, co evolution lead to ecosystem demise. A known example is Atari, which fell behind due to failure to lock out unauthorized games.

2.3. Complementor

15. Ecosystems that succeed require attendance of a full community of partners and suppliers (Moore, 1993). Today, all economists and business management specialists agree that while the platform's core technology, products or services is important, value added stems from interaction with and amongst complementors (Gawer and Cusumano, 2002, 2008; Wareham, Fox and Giner, 2015).

16. Importantly, it is not only the quantity of complementors that is critical, but also their quality and variety (Cennamo, 2018). Increasing the number of complements might be self-defeating, mitigating the relevance of indirect network effects. This plausibly explains Apple's near death experience when newly licensed Mac OS clones flooded the market. Following the false wisdom whereby cloning would lead to lower prices and higher market share (West, 2005), Apple did not anticipate that this would unleash a spiral of commodification, razor thin profits margin, and "red ocean" competition (Mauborgne and Kim, 2005). At the same time, depending on too few complementors that matter more than others is also a risky bet. The demise of a key complementor can lead to the collapse of the whole ecosystem (the anchor tenant in a mall), even though the agent is not the platform leader (Teece, 2012).

2.4. Co-opetition

17. Ecosystems partners work "both cooperatively and competitively" toward new products, services and innovation (Moore, 1993). In an ecosystem, cooperation is the handmaiden of competition (Teece, 2012). What does this concretely mean? Ecosystem members compete for the long term - making investments in resources, capabilities, and partners that pay off over time – and discount short term profit opportunities, zero sum game market share stealing rivalry or business secrecy. The aim of interaction is to "lift all boats". This "relational" ecology of competition (Chen and Miller, 2015) applies at several levels.

18. To start, a delicate balance of cooperation and competition must be struck among the providers of complements (Teece, 2018). In the 1990s, Nintendo carefully avoided fierce competition amongst complementors by curbing the number of competing video game titles released in its ecosystem and forbade game develop-ers to launch more than five title (Cennamo and Santalo, 2015). By contrast, Groupon's decision to enroll as many merchants as possible set local businesses against each other in a price war, plausibly explaining its ecosystem's desuetude.[2]

19. But platform leaders too must engage into relational modes of competition. While all this is obvious to young ecosystems facing critical mass challenges, this issue becomes important for mature ecosystems. Platform leaders face a "*fox and shepherd*" conflict of interest (Greenstein, 2020). Once they have led ecosystems partner to a strong, steady adoption outcome, platform leaders might be tempted to tweak the contractual or technological rules to their own advantage. For example, Microsoft's take- no- prisoner approach to OS and productivity software in the 1990s forced innovators to focus efforts on disruptive Internet applications like search engines and social networks, accelerating the obsolescence of its ecosystem. Ecosystem survival thus requires that governance be fierce and fair, leaving little scope for opportunistic re-contracting by platform leaders.

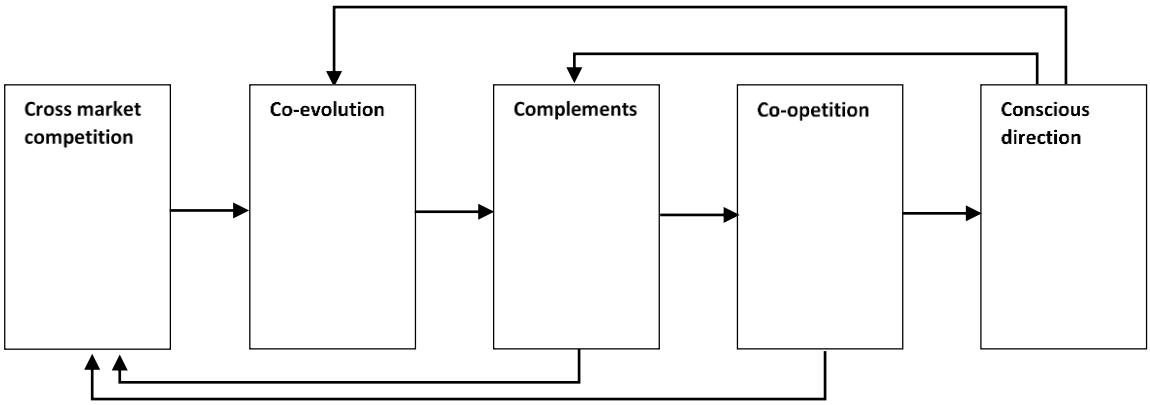
2.5. Conscious direction

20. As much as a business ecosystem is like a "*complex living entity*", it is also "*an artifact that humans can design*" (Tsujimoto et al., 2018). James Moore stressed from the outset the requirement of a "*conscious direction*" (Moore, 1993) or "*orchestration*" in business ecosystems (Teece, 2007). Though self-organized, leadership is particularly needed to propagate a vision, achieve unity of purpose, and produce consistency of action (Teece, 2018). And often, the platform owner will provide the coordinating mechanisms, rules, key products, intellectual property and financial capital (Teece, 2012) allowing it to "*bargain for a higher share of the total value produced by the ecosystem*".

21. As in all living organisms, the central contributor can change, as when power in the PC ecosystem shifted in the 1980s from hardware (IBM) to chips (Intel) and software (Microsoft) (Moore, 1993). When this is the case, revenue sharing disputes are one click away. The software industry provides an example. Former relational database and enterprise software ecosystem champion Oracle has fought a decade long court battle against Google and other younger ecosystems over unlicensed use of Java's APIs.

[2] Analyst reports show that Groupon's share value has been declining steadily since it went public in 2011. See J. Reyes, Market intelligence, 31 August 2019.

Figure 1. The Five "Cs" of Business Ecosystems



3. Specific Properties of Digital Ecosystems

22. Ecosystems are a pervasive form of business organization in the digital economy. Why? A theory of ecosystem origination and propagation in data intensive industries is too crude. Many firms in digital industries enter and expand as complementors, not platforms, and never morph into ecosystems. We may thus refine the question by asking: what initial conditions determine a firm entry as an ecosystem "central contributor" in data intensive industries (Moore, 1993)?

23. In our view, the answer to this question is given by a firm's ability and incentive to overcome a dual technology constraint. The dilemma is that value creation comes from data that are distributed, while value capture comes from computation, curating, use, and reuse that requires centralization. In the world of the modern business organization, platform leaders are the firms that specialize in orchestrating (i) *sensors* that collect, convert, disseminate, label, and restructure distributed data; and (ii) *servers* that centralize analysis, computation, correlation, reproduction, search, storage, retrieval, and filtering of sensed data.

24. Concrete examples of sensors are apps, application programming interfaces ("APIs"), smartphones, search engines, social networks, home assistants, smart watches, augmented reality glasses, payments systems, video conferencing apps, etc.

25. Concrete examples of servers are cloud-computing platforms, software as a service, data centers, super computers, artificial intelligence systems, etc. In the future, we should observe further ecosystem propagation in data servers and sensors like self- driving cars or quantum computing.

26. With all this, it is becoming increasingly attractive to consider that a key asset for value creation and capture in the digital industry (especially those that face the consumer) comes from controlling key datasets about user behaviors and preferences (and the relevant environmental factors that drive those choices) and developing the relevant capabilities to learn from, and exploit, these data across multiple domains. At the same time, however, datasets like data lakes, data warehouses and data meshes are very diverse and complex, integrating multiple different sources and types of structured, semi structured and raw tabular data, for different use cases.

27. Consequently, the set of production possibilities, monetization strategies, and competitive opportunities arising from large, diverse and numerous datasets is perhaps not

infinite, but it is indeterminate. In clearer terms, this means that there is as much economic opportunity in big data as there is uncertainty.

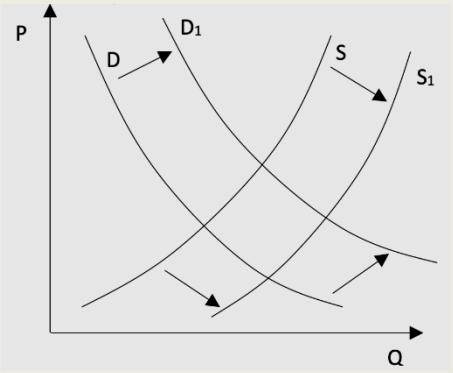
28. To see this issue one needs to understand the economics of "joint production" problems. Because data come from many different sources and can be combined with many different sources, it is not possible to predict (ex-ante) which sources and which combinations will be co-create value. The core issue here is a variation of what economists call fixed or near fixed proportions (or Leontief "production processes"). Production sometimes yields ancillary products/services that may be valuable or useless, or worse still, have negative value. Thus, the early Australian sheepherders raised sheep for wool. Mutton is a by-product and was of no value at first. But with the invention of refrigeration in the 1880's, it became a valuable, and tradable product.

29. Moreover, a "knowledge asset" problem adds up. One single piece of data (on customer behavior, for example) can be reused, and so it is a non-depreciating asset. This means that we know that a dataset might be valuable, but ascertaining its potential value (and how much it is rational to invest in its collection and analysis) is difficult because we cannot assess (ex-ante) how many times a piece of information can be reused. Another judgement call is thus required about how much money should be invested in collecting the data.

Box 1. Economic Treatment of Digital Ecosystems

In strict economic terms, the addition of data to ecosystems complements increases consumption benefits for users, shifting the demand curve (D) for ecosystem goods upward (D1). Meanwhile, data increases the marginal product of labor and capital for complements, shifting the supply curve (S) for ecosystem goods downward (S1) (or put differently, data reduces the marginal cost of production).

The result is that the production possibility frontier moves away. The ecosystem faces opportunities for growth. But subject to reasonable entry conditions, the environment shifts (see diamond zone). Moreover, the rise in surplus creates potential for strategic bargaining issues inside the ecosystem.



30. Bottom line? The existence of the above-mentioned technological constraints has important implications for firm boundaries and organizational choices, by raising the rewards to cross market, co-evolutive, and co-opetitive ecosystems. In short, digital ecosystems are not just caused by network effects or economies of scale/scope. Today, the rate and direction of Amazon, Google, Netflix and Facebook's diversification is given by

the data collected as a byproduct of user engagement with their platforms (including transactions/purchases).[3]

31. At the same time, however, we do not know much about why some digital ecosystems successfully overcome the deep uncertainty created by the joint production and knowledge asset problems, and why others fail. Neither does the theory predicts why a platform leader maintains power durably, and weathers competitive platform shifts within the ecosystem? This is what we examine in the next section.

4. Strong Dynamic Capabilities are required to Orchestrate Ecosystems

32. Complexity could be the sixth C of ecosystems. As Parker and Van Alstyne note, "*[s]trategy becomes vastly more complex as firms consider dynamic interactions of a multi-layered ecosystem*" (Parker and Van Alstyne, 2015). It is not, however, because if complexity was a regularity, there would be no incentives for rational entrepreneurs to build ecosystems. Instead, less costly market transactions (contracts) or hierarchical organizations (firms) would be preferred.

33. Here again James Moore supplied the analytical intuition. If it is true that ecosystems are as complex as biological organism, managers can "*design* longevity" into a system (Moore, 1993). The Moore wisdom calls attention to the paramount importance of dynamic capabilities in the survival of firms in general, and of ecosystems in particular (Petit and Teece, 2020). Dynamic capability *is* "*the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments*" (Teece, Pisano and Shuen, 1997). In practice, dynamic capabilities cover three sets of activities. That is the *sensing* of unknown futures, the *seizing* of business opportunities, value and needs, and the management of change by *reconfiguration*.

34. From this definition, it should be clear that dynamic capabilities matter a great deal for platform leaders. A business ecosystem's success is not structurally determined but depends on an orchestrator choosing which elements of the value chain must be internalized, and deciding what need to be supported externally, and how the various elements of the ecosystems can be aligned for continuous innovation and sufficient co-prosperity.

35. Moreover, while dynamic capabilities are central to any business ecosystem, they are critical in a digital ecosystem. The economics literature on competition in digital industries completely missed this insight. Early competition economics works predominantly investigated market failure possibility theorems. The aphorism "data is the new oil" did not help, setting a field naturally inclined to study "why firms entrench themselves" within a context of bad historical examples like the OPEC cartel or John D. Rockefeller's predatory tactics. With "seen" anticompetitive stories on the back of its mind, the mainstream competition economics profession equated control of large datasets with scale, incumbency and monopoly leveraging, and never seriously considered the need for a complementary investigation into the "unseen" business risks, challenges, and opportunities associated with operating in digital industries.

36. But data are an equal source of survival risk, firm selection, and incumbency myopia. The field of business and management science supplies the missing picture. When ecosystems involve digital asset co-creation through the interactions of structured,

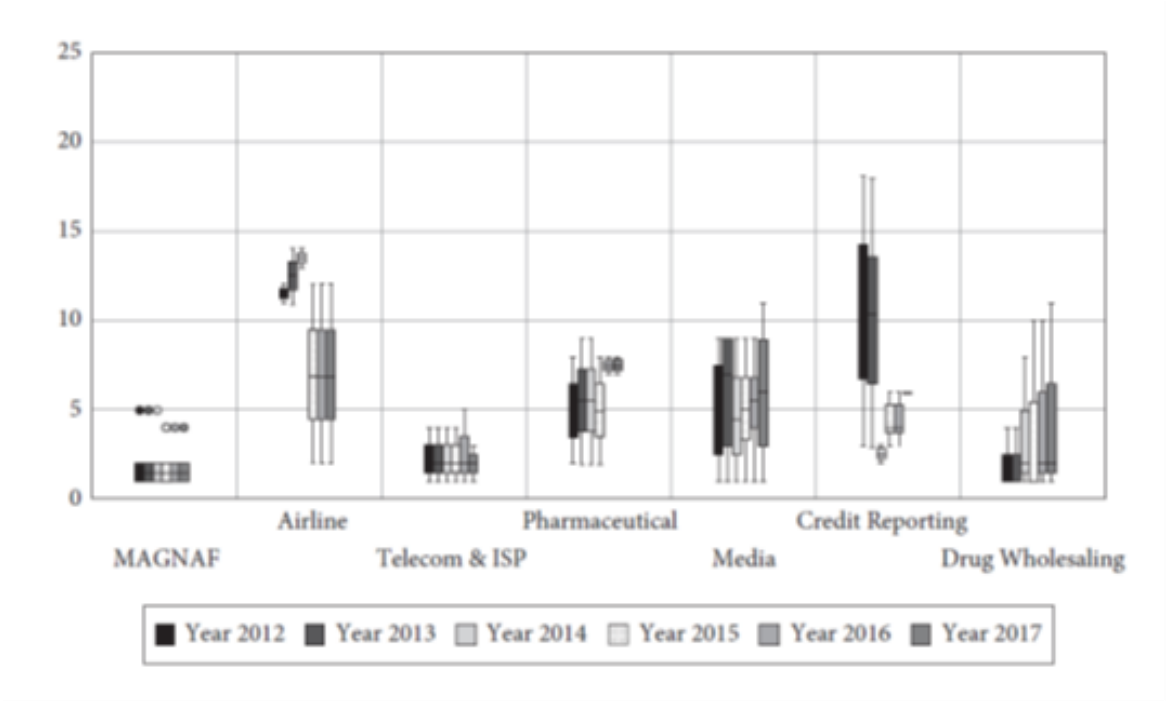
[3] Even Apple, who likes to present itself as a data-frugal firm, has heavily invested in its voice assistant Siri with real time data on users' activities, locations, and behaviors, and is now ramping investments into podcasting.

semi structured and raw data at multiple levels, the orchestration task of management are particularly difficult. Value can sure rise, but it can equally fall depending on how the data are orchestrated.

37. In the worst case scenario, the endgame is ecosystem demise, obsolescence or leadership shift to a complementor. One illustration drives the point home. The Instagram photo app once deemed "*complementary to social networks*" (CMA, 2012) might have become the central ecological contributor of the Facebook ecosystem, had Mark Zuckerberg not decided to acquire it.

38. The empirical evidence about the contributive role of data to competitive pressure is confirmative. When they report on "risk factors" in 10-K yearly filings, large digital ecosystems consistently single out competition as their top 1 or 2 source of uncertainty (see Figure 3 below, MAGNAF cluster). In other industries like airlines, pharmaceutical, or media, there is more variance as to how firms rank competition as a risk factor.

Figure 2. - Risk Factors: MAGNAF v Other Industries. Source: 10-K reports to the SEC, 2012-2017



Source: Petit, 2020

39. The upshot is that dynamic capabilities are paramount to digital ecosystems. Netflix CEO Reed Hastings recently wrote: "our North Star is building a company that is able to adapt quickly as unforeseen opportunities arise and business conditions change" (Hastings and Meyer, 2020).

5. Perspectives that Dynamic Capabilities open for Competition Law

5.1. Costs of conduct based antitrust v benefits of a dynamic capabilities approach

40. Competition law can be thought of as a system of incentives. In current form, competition law purports to disincentivize extraction of naked monopoly rents by

prohibiting conduct that reduces rivals' output without increasing product quality, reducing costs, or reducing above-cost prices.[4] The problem of competition law enforcement is one of imperfect information: the facts are hard to observe. Antitrust courts and agencies inevitably produce erroneous findings when they attempt to determine what a given business practice does in the particular case. In digital ecosystems, the problem is magnified. It is impossible to determine the difference in efficiency between an observed practice and some alternative experience that does not exist due to the dynamic nature of the industry. Take interoperability. All competition decision makers like interoperability. But what if, for example, Microsoft reversed engineered Zoom's protocols to allow Teams users to sign into Zoom. Would this interoperability aggression be welcome under existing competition laws?[5]

41. When faced with uncertainty about the pro and anticompetitive business conduct, a current fashion in digital industries has been to counsel intervention, not restraint (Cremer et al, 2018; Furman et al, 2018).[6] A variation on the same theme is to call for antitrust rules or standards that allow antitrust courts and agencies to disregard certain facts when they have to make a determination about the legality of specific types of business practices. Proposals to reverse the burden of proof (Caffarra et al, 2020) or to adopt *per se* prohibition rules are a case in point). In both cases, the need for precision that antitrust doctrine traditionally requires is traded off against a need for intervention. Specification errors replace implementation ones.

42. Dynamic capabilities and dynamic competition offer an alternative to this intellectual impasse. Through a dynamic capabilities lens, the focus of analysis shifts from the business practice to the business organization. When the internal and external environment of the business entity is seriously taken as a unit of analysis, a margin of progression for a refined competition law arises, without requiring fundamental doctrinal modifications.

5.2. Preliminary formulation of a dynamic competition/capabilities driven antitrust policy

43. It is interesting to think a bit about what a dynamic capabilities driven antitrust policy might look like. In this section, we discuss the function, goals, filters and tests that a dynamic capabilities driven antitrust policy would adopt. We provide here only some limited insights, referring readers to other works of ours for a more complete treatment (Petit and Teece, 2020).

5.2.1. Function: protecting the competitive process and advancing dynamic competition

44. The basic function of a dynamic capabilities driven antitrust policy would obviously be to serve the competitive process by advancing dynamic competition. It can do so by supporting the rewards for business organizations with strong dynamic capabilities (Schumpeterian rents). This means accepting that the rents to firms that embrace uncertainty are higher, and that some temporary period of monopoly power is required for

[4] We draw this definition from recent discussions with Doug Melamed.

[5] This is not a completely hypothetical example. Microsoft did this to AOL in the 1990s. See https://www.theverge.com/2014/4/21/5635488/msn-messenger-vs-aol-aim-chat-wars

[6] On the ground of implicit precautionary principle considerations (Portuese, 2020), though proof has not been brought that digital ecosystems present systemic or safety critical risks like banks or aircraft manufacturers.

innovation to be viable. And it can do so by being less sympathetic to firms with only ordinary capabilities or with weak dynamic capabilities. This means accepting that the returns to firms that fail to manage uncertainty, and instead seek government protection, are lower.

5.2.2. Goals: long term consumer welfare

45. The goal of a dynamic capabilities version of the competitive process is to produce long term consumer welfare benefits, in line with the teaching of economic theory. Firms with strong dynamic capabilities can pay better wages, retain and retrain staff, and build even better capabilities in a virtuous cycle (Abowd, McKinney, and Zhao, 2018). They are also more resilient and productive, providing a hotbed for innovative cultures (Barth et al., 2016). And they invest higher amounts of R&D, leading to a high multiplier effect on social welfare. A survey showed that the social rate of return to private R&D was about twice that of the private return (Hall et al, 2010). Without the firm-level capabilities to create, develop, and deploy technological change, capitalist economies cannot attain rapid rates of growth (Baumol, 2006; Metcalfe et al, 2006). Therefore, one cannot explain the wealth of firms, and in turn of nations, without a theory of capabilities (Sutton, 2012).

5.2.3. Filters and Tests

46. A dynamic capabilities driven competition policy would rely on concrete practical filters and tests to diagnose and remedy of market failures. Much work remains to be done to fully operationalize a dynamic competition approach to competition policy that recognizes that dynamic capabilities are as important to outcomes as innovation itself.

47. Yet, we provide some early insights in the following table below. We do this hoping to generate interest from economic, legal and policy thinkers who believe that the law can evolve to improve welfare.

Table 1. Some rudimentary and preliminary differences between conventional antitrust and dynamic capabilities questions

Conventional antitrust question	Dynamic capabilities question	Indicators	Sources
What is the relevant market?	How many industries does the ecosystem cross?	SIC, Fama French, etc.	10Ks
Who are its competitors, ie actual or potential suppliers of substitutes?	Who are a company's key competitors from an ecosystem point of view?	"Peer group" analysis including other ecosystems, platforms and complementor	Competitor, Comparable or Related firm search tools and "company profiles", 10Ks
What's the company share ?	Is the company operating in an environment of uncertainty, and if yes, is it investing in dynamic capabilities?What is the strength of the company's ordinary and dynamic capabilities?	Degree of effort, Investment in change, longevity, and resilience	• R&D exp. and intensity • Marketing exp. • Employment exp. • Patient capital/retained earnings • Internal competition
What happens if the market price increases by 5% over 1y?	What happens if the firm stops investing in technology in next 4y?	Hypothetical Lazy Monopolist Test (HLMT)	TBD
Is the business practice anticompetitive by purpose or effect?	Is the business practice "coherent" in light of the longevity, survival, and resilience requirement of the ecosystem?	Is the ecosystem "fox" or "shepherd"?	Are Amazon private labels coherent to uphold Amazon's long-term commitment to low prices? Test: • Shepherd if Amazon exit when

			prices have gone down: • Fox if Amazon stays in product category and charges pre-entry prices
Is the business practice objective justified?	What lifecycle phase has been reached by the ecosystem, and is the practice aligned?	M&A events, pre or post IPO, etc.	Interoperability restrictions make little sense when an in the pre-paradigmatic launch phase of ecosystem development, but make more sense in the leadership phase (Teece, 1997)

6. Conclusion

48. We are not the first to suggest that conventional economic policy frameworks are insufficient. The OECD itself recognized the important of advancing dynamical efficiencies and has spearheaded a knowledge building effort called New Advances to Economic Challenges with a view to embrace the complexity of the modern economy.

49. Dynamic capabilities provide us with a preliminary understanding of the determinants of competition between ecosystems, and what drives their success and failure.

50. The question, of course, is should we seriously bother building a complementary model of dynamic capabilities based antitrust? Is the investment worth the benefit? Or put differently, how much competition do we lose under application of established analytical methods?

51. Our answer is: we're missing broad spectrum competition that delivers innovation, which in turn is the main driver of long term growth in capitalist economies.

52. Our call to complement the existing antitrust toolkit with dynamic capabilities is hardly a personal fad. In 1945, Justice Learned Hand noted in Alcoa that a firm might achieve market power "merely by virtue of his superior skill, foresight, and industry" and ought on that account be given some latitude. In 1967, Jean Jacques Servan Schreiber wrote what Europe needs is "the ability to transform an idea into reality through… the talent for coordinating skills and making rigid organizations flexible". And just some years ago, Mariana Mazzucato observed, "the concept and practice of dynamic capabilities is perhaps the key missing element in the search for the new generation of innovation policies" (Kattel and Mazzucato, 2018).

53. It is about time to put substance behind economists and lawyers long time admonition to inject more dynamism in our analysis of competition. An antitrust renaissance, not a revolution, is long overdue.

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