THE NEXUS BETWEEN INNOVATION AND COMPETITION: WILL THE NEW DIGITAL TECHNOLOGIES CHANGE THE RELATIONSHIP?

BY ELIZABETH WEBSTER[1]

1 Swinburne University of Technology. From a conference held in April 2019 at the University of Melbourne.

CPI ANTITRUST CHRONICLE
FEBRUARY 2020

I. INTRODUCTION

As topics for discussion, innovation and competition have long been intertwined. Will innovation produce the behemoths that choke competition and lead to the dominance of fewer and fewer firms? Does ruthless competition between near-identical firms smother the profits needed for risk taking? Will the shift from mechanical and electronic platforms towards digital ones exacerbate these trends?

In this article, I examine how the competition – innovation debate has progressed and suggest that the (voluminous) research which tests whether lack of competition holds back innovation is possibly asking the wrong question. I then look briefly at whether the recent new wave of digital innovation is creating larger firms and more concentrated markets.

II. HOW ECONOMISTS CONCEPTUALIZE COMPETITION

Competition, between firms for customers and scarce inputs and workers for jobs, is the fundamental force allowing economists to predict the direction of economic change resulting from a given modification in conditions. By extrapolation, competition transforms economies as changes in one market places strains on others.[2] This pivotal role of competition harks back to Adam Smith's 1776 tract, which illuminated the role prices played in guiding people's behavior. Since then, considerable attention has been given by the economics profession to defining, measuring and identifying competition.

So what is competition? Competition is a race. For firms this largely means a race to win more customers through cheaper, better or more accessible products. Faster races make for more efficient and dynamic product offerings, or so the theory goes. Fast races depend on the internal drive of participants and external pressures. In a winner takes all race, competition is expected to be more extreme than in a race where all participants get a prize.

III. INNOVATION AS A WAY TO COMPETE

Innovation – i.e. change – is the route to these cheaper, better and more accessible products. The process of outmaneuvering rivals may cut prices down to the unit cost level, but beyond this, more efficient forms of production are needed to reduce prices. And, by definition, this improved efficiency depends on either new-to-the-firm or new-to-the-world innovation.

2 Landes, D. (1969), *The Unbound Prometheus*, Cambridge University Press.

A. Measures of Competition

Economists have struggled to measure the speed of competition in a meaningful way. A logical metric would be a (weighted) count of the activities of firms to create these cheaper, better and more accessible products. However, records of these activities are hard to obtain in a systematic and unbiased way, even in our current information-cum-big-data age.

Therefore, other, more expedient, measures of competition dominate the literature. Two common measures actually represent drivers of competition – the number of sellers in a market (or market concentration) and barriers to market entry. The logic behind the market concentration metric is that fewer market participants enable a level of (tacit) collusion over prices.[3] The Herfindahl Index and CR4 metric are the prime examples here. The logic behind the barriers-to-entry measures is that an anticipation of losing customers motivates firms to act first. A third measure – the ratio of price to unit cost – is a supposed outcome of this rivalry. But price-cost margins largely assume competition is just price competition which, as discussed above, is a narrow, and uninteresting, view.[4]

B. Is there Evidence that more Vigorous Competition invokes Innovation?

There has been a multitude of studies to assess the effects of competition on innovation. In the main, these studies devolve into an estimation of the effect of market concentration, or barriers to entry, on R&D or patenting. There appear to be no studies examining the effect of price-cost margins on innovation (the closest being the effect of cash flow on R&D spending, see Cohen 2010).[5]

An argument posed by Schumpeter (1934, 1942) and subsequently explored by Mason (1951), Horowitz (1964) and later others,[6] was that by permitting higher profits, concentration (i.e. collusion) would both provide the funds for investment into innovative activities, and, lock-in future returns from executed innovations. A variant of this theory proffered by Cohen & Klepper (1996) is that large firms have an advantage performing radical innovation because they can afford to fail.[7] They are not bankrupted by a single unsuccessful innovation. However plausible these theories, the empirical results have been ambiguous

The barriers-to-entry definition of competition has also been explored. Blair (1948),[8] Geroski (1989),[9] and Acs & Audretsch (1991)[10] were among the earliest writers to ascertain the positive effect of weak barriers to entry on innovation but with a cautious note that they are probably codetermined.

The doyen of innovation and competition, Wesley Cohen (2010), concluded after reviewing the literature, that high or low R&D intensity can occur in both high and low concentrated markets depending on third factors, and, it is likely that competition and innovation are simultaneously determined.

These studies are however hampered because there are few fully satisfactory off-the-shelf measures of competition. Using market concentration as a reliable proxy for the speed of the race often flies in the face of common sense. Mobile phones, computers, microchips, and automobiles are considered some of the most concentrated yet innovative markets. Similarly, the rivalry driven by weak barriers-to-entry, as found in hospitality and retail trade, may merely play out as price cutting activities.

---

3 Smith, A., (1976) [1776], The Wealth of Nations: An inquiry into the nature and causes of the Wealth of Nations. The University of Chicago Press, Chicago.

4 It seems plausible to assume that the focus in economics on the "miracle of the price system" has subsequently led economists to narrowly define competition as merely price competition.

5 Cohen, W.M. & Klepper, S., (1996), A reprise of size and R & D. The Economic Journal, 106, 925-951. There is little *a priori* reason why price-cost margins would reflect the speed of the race to improve long-term efficiency, create new products and improve market access.

6 Schumpeter, J.A. (1942), *Capitalism, Socialism and Democracy*, 3rd edition, London: George Allen & Unwin, 1976. Mason, E.S., 1951. Schumpeter on monopoly and the large firm. *The Review of Economics and Statistics*, pp.139-144. Horowitz, I., 1962. Firm size and research activity. *Southern Economic Journal*, pp.298-301.

7 Cohen, W.M. & Klepper, S., (1996), A reprise of size and R & D. *The Economic Journal*, 106, 925-951.

8 Blair, J.M., (1948), Technology and size. *The American Economic Review*, 38(2), pp. 121-152.

9 Geroski, P.A., (1989), Entry, innovation and productivity growth. *The Review of Economics and Statistics,* pp. 572-578.

10 Acs, Z. J. & Audretsch, D.B. (1991), 'Innovation as a Means of Entry: An Overview', in Schwalbach, J. & Geroski, P. eds., 1991. *Entry and market contestability: an international comparison*. Basil Blackwell, Oxford.

Surprisingly, the quantity of literature questioning the reverse causation, i.e. the role innovation plays in creating concentrated markets or barriers-to-entry, is thin and even passé (i.e. see the 1940s concentration of capital literature by Paul Sweezy and colleagues). If firms vie for profits, surely a good strategy would be to invest in new products, processes and the means of accessing consumers, so that the firm can increase its distance between themselves and their nearest rivals?

IV. RE-PHRASING THE QUESTION

The literature which has tried to draw a causal link from market concentration to innovation has reached the end of its natural life. If we were to be uncharitable, we would say it has been an unfortunate distraction from bigger issues.

If we accept that innovation is the only long-term way firms compete, then it does not make sense to treat competition and innovation as separate and distinct concepts. Rather than worrying about recording the effect on, or consequences of, an intractable concept such as competition, I argue that we should be focusing on the effect of innovation on our societal end-goals, of householder well-being, and the health of civil society.[11]

In the remainder of this article, I give a preliminary discussion on how digital technology might affect these social goals in part by providing cheaper, better and more accessible products. I focus on whether digital innovation represents a break from past forms of innovation and, if so, how.

V. DIGITIZATION IS…

"…the conversion of text, pictures, or sound into a digital form that can be processed by a computer."[12] The technology was created at Bell Labs in the 1940s and involved combining transistors, which can record millions of zeros and ones, with the mathematics articulated by Shannon's Information Theory (Gertner 2013).[13] Digital technologies can store information, automate physical processes, and make calculations and pattern recognition activities hitherto beyond human ability.

Digitization has loomed large in public discourse because of its non-rivalrous and non-excludable character. Non-rivalry occurs because once the original product has been made, users can make copies, at minimal cost, that are both identical to the original and transferable between media. Non-excludability occurs because it is technically impossible, in most cases, to prevent other parties from making these copies.

However, this new technology may not be as radical as we imagine. Non-rivalrous and non-excludable goods have been with us for ever – the most basic example being knowledge. Similarly, the question of whether we should artificially curtail the use of non-rivalrous and non-excludable products has also been with us for a long time. In the case of knowledge, this took the form of the patent, copyright and publishing debates. It is received wisdom that limiting the ability to reproduce non-rivalrous non-excludable products is needed to provide an inducement to invest in their creation. Any short-term deadweight loss caused by this curtailment, is outweighed by the social gain of a (perpetual) new product. Against this view are numerous examples, illuminated by Moser, Mokyr, Mowery, Trajtenberg, Rosenberg, and Bresnahan from history, which show that early access to non-rivalrous intermediate products (in the main by not artificially restricting use via patents), is important for extracting their full social value.

It would be hard to objectively prove that non-rivalrous inputs are of greater value to the functioning of our economies than in earlier epochs, but it is easy to show that investment into digital technologies has risen dramatically since they first appeared in the 1950s (Brynjolfsson & Kahin, 2002;[14] Katz & Koutroumpis, 2013).[15]

---

11 Many of the problems from large anti-competitive firms arise from their power to interfere in politics, create artificial barriers to entry via political influence, restrict the flow of knowledge and information via golden handcuffs, and non-compliance with tax laws.

12 See https://www.lexico.com/definition/digitization.

13 Although there were forerunners of the ideas such as Babbage's analytical engine and the telegraph. See Gertner, J. (2013), *The Idea Factory: Bell Labs and the Great Age of American Innovation*, New York: Penguin.

14 Brynjolfsson, E. & Kahin, B. eds., 2002. *Understanding the digital economy: data, tools, and research.* MIT press.

15 Katz, R.L. & Koutroumpis, P., *Measuring digitization: A growth and welfare multiplier, Technovation,* Volume 33, Issues 10–11, October–November 2013, pp. 314-319.

But digitization is not just another form of knowledge in three important respects. In the past, knowledge (which is non-rivalrous and often non-excludable) had often to be embodied in physical goods, such as machinery (which are rivalrous and excludable). Digitized knowledge, on the other hand, is embodied in code which is also non-rivalrous and non-excludable. Hence, market failures associated with expropriation of its innovation profits will loom larger. Secondly, the value of many digital technologies depends on their interoperability and network externalities. Some markets are winner-takes-all, and when the winner does emerge, there is an extreme imbalance of power and a potential threat to civil society. The latter may take the form of excessive income inequality and political interference.

And thirdly, digital technologies are not just another technology. According to Bresnahan & Trajtenberg (1995), digitization is a general-purpose technology, like the steam engine and electricity.[16] It enables and enhances other technologies. There is a widespread view that patents on the steam engine and electric light held back development (see the discussion in Selgin & Turner 2011).[17] However, the problem may be the rules around the operation of patents rather than patents *per se*. Howells (2008), for example, examined the innovation-blocking patents in the automobile, radio, aviation, and electric lighting industries and concluded that diffusion and development was limited by the administration of patents (meaning internal patent office processes, elongated infringement cases, and inefficient licensing) rather than the existence of the patent.[18]

VI. DIGITIZATION IS THE CONDUIT FOR CHEAPER, BETTER AND MORE ACCESSIBLE PRODUCTS

The research literature on the effects of digitization, via neural network algorithms, robotics, sensors and ICT, among other things, is largely dominated by case studies and selected products and industries. Anecdotally, we all know of examples where digital technology is replacing routine service activities, such as interpreting X-rays, monitoring quality, assembling products, selecting job applicants, handling customer support phone calls, and driving cars. In addition, many old products, such as TV, phones and cars, are shifting from electronic to digital platforms.

There are few representative studies on the effects of digitalization but one relevant study by Bessen & Righi (2019) has found that major IT investments lead, on average, to large increases in demand for the firms' products.[19] Other than this, it is difficult to find representative studies that support the proposition that these new technologies have led to lower unit costs and prices. Perhaps it is too early.

Similarly, we can all point to products that would not exist were it not for digital technologies, such as big data, mobile phones, computer games, word processors *inter alia*.

And finally, the emerging literature on global value chains and online purchasing is testament to how digitization has extended the reach of producers into new and distant markets (Athukorala, Talgaswatta & Majeed, 2017).[20] History has shown that where the costs of communication, transport and logistics, in terms of speed, quality and reliability, widens markets, it leads to reinforcing second-round effects. This is well illustrated by Mokyr (2010), who argued that by making Britain one market, the 18th century canals and improved sea and road routes enabled the early fruits of the industrial revolution to quickly reap economies of scale.[21]

Correlation is not causation, but it can be suggestive. If the opportunity offered by digital technologies motivates firms to introduce cheaper, better and more accessible products more quickly than otherwise, then we would expect to see a positive relationship between digitization and a change in GDP per capita. We do not have this information but in Figure 1 Katz & Koutroumpis (2013) show that there is a very strong positive relationship between digitization and GDP per capita levels across countries.

16 Bresnahan, T.F. & Trajtenberg, M., 1995. General purpose technologies 'Engines of growth'?. *Journal of Econometrics*, 65, 83-108.

17 Selgin, G. & Turner, J.L., 2011. *Strong steam, weak patents, or the myth of Watt's innovation-blocking monopoly, exploded*, The Journal of Law and Economics, 54, 841-861.

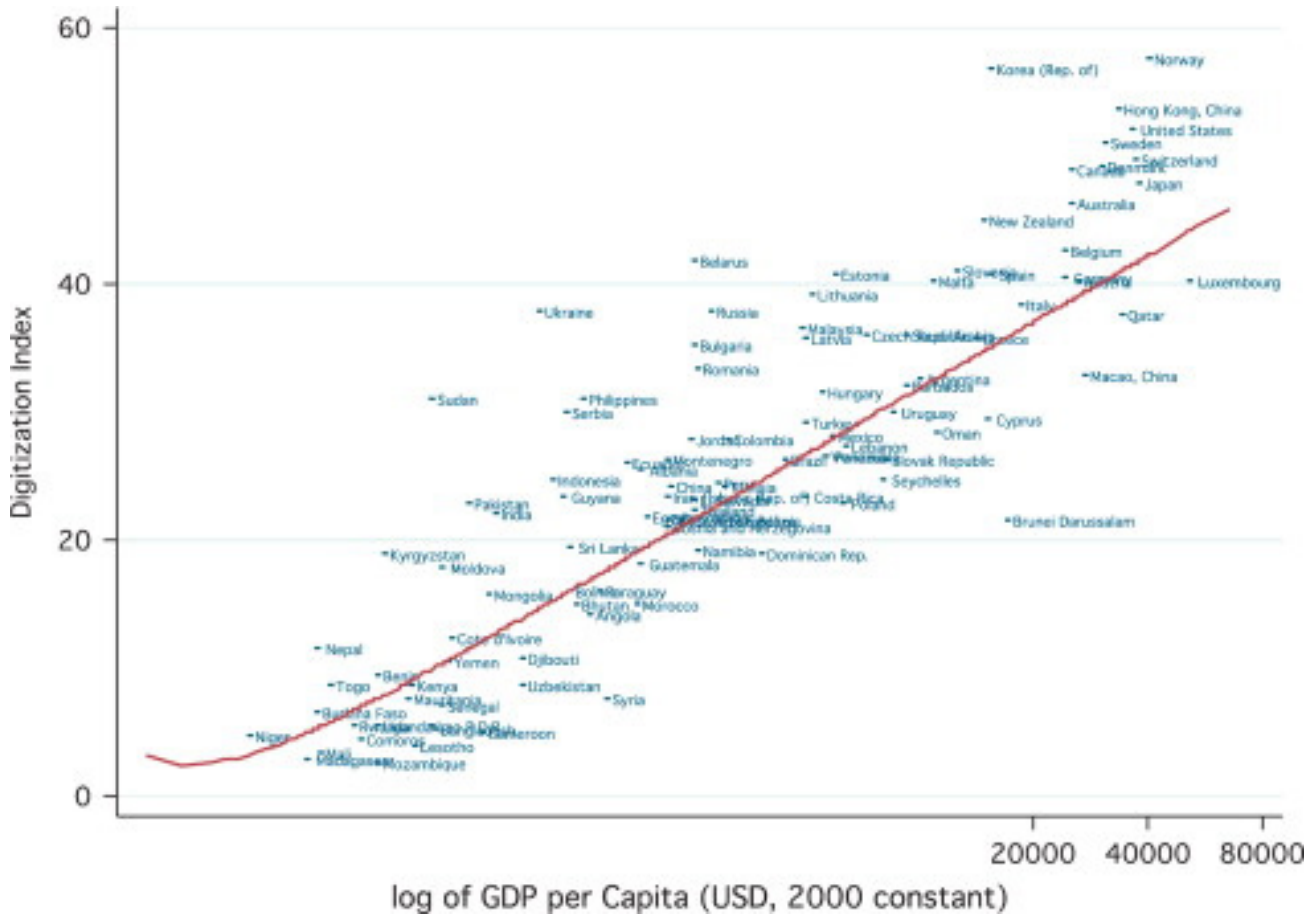
18 Howells, J., 2008. Patents and Downstream Innovation Suppression–Facts or Fiction? - A Critique of the Use of Historical Sources in Support of the Thesis that Broad Patent Scope Enables the Suppression or Hindrance of Downstream Useful-Technology Development. Centre for Organizational Renewal and Evolution, Working Paper-2008–01. Available at http://www.pucsp.br/icim/ingles/downloads/pdf_proceedings_2008/11.pdf.

19 Bessen, J.E. and Righi, C., 2019. Shocking Technology: What Happens When Firms Make Large IT Investments?. *Boston Univ. School of Law, Law and Economics Research Paper*, (19-6).

20 Athukorala, P.C., Talgaswatta, T. & Majeed, O., (2017), Global production sharing: Exploring Australia's competitive edge. *The World Economy*, 40(10), pp. 2172-2192.

21 Mokyr, J., (2010), *The Enlightened economy an economic history of Britain 1700-1850*. Yale University Press.

Figure 1: Digitization index with log of GDP per capita in 2010.



Source: Katz & Koutroumpis (2013).

VII. POLICIES TO AMELIORATE THE NEGATIVE EFFECTS

Regardless of the likely benefits from digitization, the question we must now pose is: Are the existing institutions for managing non-rivalrous and non-excludable products fit for purpose in the new digital age?

Patents and copyright, being the legal frameworks designed to increase incentives to create ideas via raising the excludability of information and knowledge, have well known contraindications. They can generate monopoly power, and in certain circumstances, can hinder diffusion and development. Complementary policies, to ensure patents and copyright do not both strengthen market concentration and delay development and diffusion, should be reinforced. Consideration should be given to increasing the use and prevalence of licenses-of-right, standards on inter-operability, open networks, FRAND, and more transparent, faster examination systems. As an enabling technology, it is important to encourage both diffusion and ongoing development of digital technologies.

It may be inefficient to block natural monopolies (where the size of the market only permits one firm to operate at the most efficient level). However, their ill effects may be mitigated by complementary policies to check the abuses of power such as technical inefficiency, extreme executive salaries and monopoly pricing. Solutions need be pragmatic, and might include public ownership, regulation and quid-pro quo deals such as those done between the US Government and AT&T (Bell Labs), IBM, and Du Pont in the 1950s.

Copyright needs a complete re-think. The most obvious reform would be to reduce the term to 20 years. With time discounting, any revenue beyond 20 years is not going to affect the incentive to be creative. It is just a payment for effort in the distant past.

The collation and dissemination of information and data is one industry to clearly benefit from the digital revolution. A growing number of organizations collate data and make it available at low cost to users. By reducing the information barriers to entry to clients, it offers a marvelous service. Usually however, this industry is a natural monopoly, which makes it suitable for public ownership (national and university statistical services). However, the blooming private sector (e.g. Google, DataStream, Connect4, LinkedIn, Bureau Van Dijk) suggests some public oversight is needed. The issue is how close are the next best substitutes and are these private providers using price to exclude small or less well-resourced customers. These questions have yet to be fully explored.

And finally, as with all economic restructuring, the value of programs to enable displaced workers to transition to new industries and occupations should be objectivity evaluated and improved to minimize disruption to the digital casualties and enhance the health of civil society.

CPI COMPETITION POLICY INTERNATIONAL

CPI Subscriptions

CPI reaches more than 35,000 readers in over 150 countries every day. Our online library houses over 23,000 papers, articles and interviews.

Visit competitionpolicyinternational.com today to see our available plans and join CPI's global community of antitrust experts.