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Agenda

Advancing economics in business

Fight in court or compete in the market? The strategic challenge for high-tech firms

In high-tech consumer markets, firms may be better off facing market-expanding competition than by seeking market dominance through, for example, refusal to license an essential patent or through patent litigation, and subsequently having to drive the market forward as a monopolist. What are the economic reasons for this counterintuitive proposition?

High-tech markets are characterised by the constant innovative effort made by firms seeking to outperform, or outsmart, their rivals. Such firms are lured by the prospect of substantial profits if they manage to introduce that 'killer application'. At the same time, there are often legal disputes about patent infringements and the terms and conditions on which patents are licensed. There is a clear and important interaction between innovative markets and the legal system—particularly as regards intellectual property rights. This provides firms operating in these markets with strategic opportunities and challenges.

From a firm's own profit-maximising perspective, a balance needs to be struck between competing with rivals in the market on the one hand, and seeking to exclude rivals through actions such as refusal to license or launching patent infringement proceedings on the other. Perhaps counterintuitively, striving for monopoly through legal actions may not always be the optimal strategy. (This is a different question from what is the right balance between competition and monopoly in innovative markets from a social perspective.)

This article sets out the general trade-offs between competition and monopoly from a firm's perspective, and describes these competitive dynamics in a game-theoretical framework.

Competition, innovation and market growth

High-tech consumer products, such as PCs, mobile phones, Blackberry handsets and MP3 players, share the following economic characteristics.

— **R&D intensity**. They are relatively R&D-intensive, resulting in continuous innovations in product features, which help to expand the market by increasing the attractiveness of products for consumers.

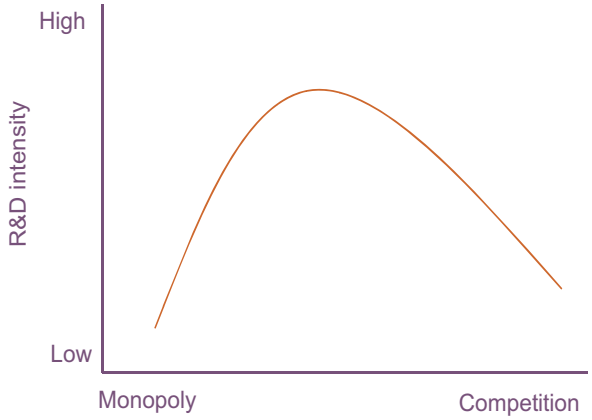
— **Network effects**. Firms might find it profitable to promote entry, competition and imitation by other firms in order to expand the whole market ('ecosystem'), and thereby enhance profits.

— **High advertising expenditure**. In the early stages of a product's life cycle, the need for relatively high levels of advertising expenditure in the product category has a significant market expansion effect, benefitting all players active in the market.

For many years, economists have been interested in exploring the relationship between market competition and R&D intensity. The first generation of the economics literature on R&D predicts that innovation should decline with competition because more competition reduces the potential monopoly rents that can be obtained by successful innovators (and these rents are in turn required to invest in R&D). This negative relationship between competition and R&D is referred to in the economics literature as the 'Schumpeterian effect', after the Austrian economist, Joseph Schumpeter, who postulated that it is the prospect of earning monopoly rents that drives firms to invest and innovate.[1]

The more recent economics literature has established that innovation rates depend less on post-innovation profits or rents (as in Schumpeter) than on the difference between the pre- and post-innovation profits. These models predict that the difference between pre- and post-innovation rents is much greater in an oligopoly with a few large players than in a monopoly. Therefore, all else being equal, firms' incentives to invest in R&D should be greater in an oligopoly. This positive relationship between competition and R&D has been referred to as the 'escape-the-competition' effect.[2] This

Figure 1 The inverted-U relationship between the degree of competition and R&D intensity



Source: Based on Aghion, Bloom, Blundell, Griffith and Howitt (2005), op. cit.

inverted-U relationship is shown in Figure 1. When moving away from monopoly to greater competition, the level of R&D investment increases through the escape-the-competition effect. However, when the intensity of competition exceeds a certain level, this reduces innovation again through the Schumpeterian effect.

In general, it should be expected that in industries where market growth is highly dependent on continuous innovations in product features stemming from R&D investment, firms could benefit from the presence of rivals innovating for the market. Although the primary incentive of any firm investing in R&D is to become a market leader, innovations in certain markets have the property of benefitting not only the innovator, but also its competitors. An example of such competitive dynamics can be found in the video games market (see the box below).

Various studies have analysed the strategic incentives of firms in the presence of network effects, and conclude that firms may rationally decide to encourage competition and imitation by clones, or license an innovation for free.[3] Other studies show that inviting competition is just one of many strategies available to firms in the presence of network effects.[4] Most studies agree that, while in markets without network effects, innovating firms may often employ legal attacks to prevent imitation, this is unlikely to be the most optimal strategy in markets with strong network effects.

Building on these studies, Sun, Xie and Cao (2004) highlight the fact that inviting competition (or 'technology licensing') is just one of four strategies available to innovating firms, the other three being as follows.

– **A single-product-monopoly strategy**. The innovator is the exclusive seller of the product based on its technological standard.

– **A product-line-extension strategy**. The innovator internally creates compatible products with multiple qualities.

– **A combination strategy**. The innovator simultaneously licenses its technology and expands its product line.

The single-product-monopoly strategy is found to be preferable when network effects are relatively weak. However, the monopoly position to which the study refers is not a monopoly in the relevant market, but one for the particular product/standard produced and sold by the firm in question. For example, a single-product-monopoly strategy has been observed in the video games market, where each manufacturer effectively holds a monopoly over its games console.[5]

Video games

During the late 1970s and early 1980s, Atari was the main supplier in the video games industry and did not face significant competition. Although it was one of the pioneers in the market and helped to create the market for video games, its games appeared to lack quality—they were considered poor in design and could be relatively easily mastered by users.[1] The 'poor quality' ultimately led to a steep fall in the demand for video games, and by the mid-1980s the market for video games was in decline. One of the main reasons for this low quality could have been that, during the early 1980s, Atari changed its focus from R&D to marketing and sales and, as a result, may not have invested sufficiently in innovation.

However, the market for video games recovered after Nintendo entered the market and invested heavily in R&D, producing games of significantly higher quality. The market quickly attracted new players such as Sega and Sony, and the industry has since been characterised by aggressive competition and leapfrogging in technology—for example, as Sega announced the introduction of 32-bit systems, Nintendo was planning to launch a 64-bit system.[2] Subsequently, R&D competition among players has helped to enhance the interest of the consumers in the video games industry, as an increasing array of product features were introduced (partly driven by another entrant, Microsoft).

Notes: [1] Church, J. and Ware, R. (2000), *Industrial Organization: A Strategic Approach*, Boston: McGraw-Hill, p. 116.
[2] Office of Fair Trading (2002), 'Innovation and Competition Policy: Part 2—Case Studies: Economic Discussion Paper 3', March, p. 19.

In addition, the Sun, Xie and Cao (2004) study finds that when network effects are strong, the technology-licensing or product-line-extension strategies become more attractive—the higher the cost of extending the product range, the less attractive this option will be. Moreover, when product-line-extension costs are neither too high nor too low, a combination strategy is found to be optimal. For example, such a combination strategy is adopted by Palm in the personal digital assistant market where it licenses its operating system, Palm OS, to competitors such as Handspring, Sony, Nokia, Samsung, and Acer, while at the same time offering a wide range of its own products.[6]

Finally, advertising can be a key driver of market growth for high-tech consumer electronics products, particularly in the early stages of a product's life cycle, when firms have the dual objective of generating awareness of the product category and building a recognised brand. When penetration rates for a particular product category are still low, advertising by any firm in the market will have the effect of expanding the demand for all firms active in the market—that is, advertising exhibits positive spillover effects; advertising by one firm helps to drive the whole product category forward.

There is also a specific benefit in the early stages of a product if, through advertising, firms succeed in making a product a separate 'category' in the eyes of consumers, thus creating greater opportunities for 'specialist' category players as opposed to 'generalist' high-tech consumer product players. Again, firms benefit from their competitors' market-expanding efforts.

A game-theoretical interpretation of competitive dynamics

The competitive dynamics in high-tech markets can be incorporated into a simple game theory framework in order to understand the interdependence and strategic interaction between firms, as well as to shed light on the optimal course of action that firms could take in markets characterised by the presence of sequential and complementary innovations, network effects and advertising spillovers.

In the interest of simplicity, it is assumed that there are two firms (A and B), which must each decide between two strategic options:

– 'compete' in the market;
– 'fight' in the courts (alternatively, this could have been modelled as refusal to license a vital patent—the logic of the model is the same).

When both firms compete in the market, they obtain profits (in net present value terms) of 100. When they fight in the courts, they each obtain profits of 80. There are two possible explanations for the lower payoff that both firms would obtain if they fight in the courts instead of compete in the market.

– Fighting in the courts utilises valuable monetary and human resources, which could otherwise have been spent on R&D and advertising, and/or in developing competitive strategies to deal with new entrants.

– There is a non-zero probability that both firms win their respective patent disputes. If, as is frequently the case, both hold certain essential patents for the product in question, this would essentially mean that they would be unable to continue selling their products unless they agreed to settle the dispute—agreeing on whether A should pay B or B should pay A, and how much, can be a lengthy and costly process in terms of forgone profit.

If only one firm fights and the other does not retaliate and continues to compete in the market, there could be two possible outcomes in terms of the profit that the 'fighting' firm would obtain (assuming that fighting succeeds in driving the rival firm from the market):

– **a profit greater than 100 (eg, 150)**—under the assumption that it is able to attract a large proportion of its rival's customers and drive the market forward on its own;
– **a profit lower than 100 (eg, 90)**—under the assumption that the loss of the competing firm would lead to reduced growth of the market (for the reasons set out in the previous section).

The strategic options and the payoffs of each firm can be shown in a 2×2 matrix, as in Figure 2. The amounts in brackets correspond to the payoffs that each firm would obtain under each potential scenario. For example, in the top right-hand corner of panel A—where firm A has chosen to fight and firm B has chosen to compete—firm A obtains a payoff of 150 and firm B a payoff of zero.

In panel A, it can be shown that each firm has the rational incentive of fighting in the courts, irrespective of the strategic choice of the rival firm. For example, if firm B chooses to compete, firm A would find it rational to fight since it can obtain a profit of 150 > 100. On the other hand, if firm B chooses to fight, firm A has no other option but to retaliate by fighting since 80 > 0. Firm B faces the same incentives. In economics terms, to fight is the dominant strategy, and the game shown here is similar to the classic prisoners' dilemma (where two prisoners individually choose to 'confess' the crime for fear of being betrayed by the other, whereas both would have been better off if neither confessed). A certain

Figure 2 Game theory framework of competing in the market versus fighting in court

Firm B

Firm A	Compete	Fight
Compete	(100, 100)	(0, 150)
Fight	(150, 0)	**(80, 80)**

Panel A: 'Fight' is a dominant strategy for both firms. The unique equilibrium is therefore (fight, fight), but firms could be better off by competing in the market—the classic prisoners' dilemma

Firm B

Firm A	Compete	Fight
Compete	**(100, 100)**	(0, 90)
Fight	(90, 0)	**(80, 80)**

Panel B: No dominant strategy and, therefore, two possible equilibriums. If one firm fights, the optimal response is for the other to fight, but firms could be better off in the 'good' (compete, compete) equilibrium

Note: The shaded cells are equilibrium outcomes.
Source: Oxera.

('ceasefire') agreement is required between the two players to reach the optimal outcome for both.

In panel B, both firms choosing to fight is also an equilibrium, but it is not the only one: if one firm expected the other to compete, its rational response would be to also compete since 100 > 90. It is only when a firm expects its rival to fight that it is optimal for it to retaliate by fighting since 80 > 0.

This simple game theory framework highlights the following key points.

– An individual firm will always retaliate by fighting in court if its rival firm chooses to fight in court.

– However, firms can always be better off if they both choose to compete in the market since they would obtain profits of 100 > 80.

– This (compete, compete) scenario might not be a stable equilibrium if a firm expects higher profits from successfully driving its competitor out of the market—in panel A, when 150 > 100. Nonetheless, for both players to achieve this optimal scenario, a certain agreement would be required not to fight each other in court, but rather to compete on the merits.

– Nevertheless, in industries where demand growth is highly dependent on market-expanding competition and R&D intensity, and where network effects and advertising spillovers are important, the (compete, compete) scenario can be a stable equilibrium, and no profit-maximising firm should have an incentive to unilaterally decide to fight in court—in panel B, when 90 < 100. In other words, it makes sense for both firms to compete on the merits rather than to fight through litigation.

Concluding comment

Firms in high-tech consumer markets may be better off facing market-expanding competition than if they were to seek market dominance through, for example, refusal to license an essential patent or through patent litigation, subsequently having to drive the market forward as a monopolist. The challenge is for each firm to assess whether the market in which it operates would be more like panel A or panel B.

[1] Schumpeter, J.A. (1942), *Capitalism, Socialism and Democracy*, 1975 edition, New York: Harper & Row.
[2] Aghion, P., Bloom, N., Blundell, R., Griffith, R. and Howitt, P. (2005), 'Competition and Innovation: An Inverted U Relationship', *The Quarterly Journal of Economics*, **120**:2, May, 701–28.
[3] See, for example, Conner, K. (1995), 'Obtaining Strategic Advantage from being Imitated: When can Encouraging "Clones" Pay?', *Management Science*, **41**:2, 209–25, February, 210; and Economides, N. (1996), 'Network Externalities, Complementarities and Invitations to Enter', special issue of *The European Journal of Political Economy on The Economics of Standardization*, **12**, 211–32.
[4] See, for example, Sun, B., Xie, J. and Cao, H. (2004), 'Product Strategy for Innovators in Markets with Network Effects', *Marketing Science*, **23**:2, Spring.
[5] Ibid., p. 250.
[6] Ibid., p. 244.

If you have any questions regarding the issues raised in this article, please contact the editor, Derek Holt: tel +44 (0) 1865 253 000 or email d_holt@oxera.com

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