Rent protection as a barrier to innovation and growth

Abstract We build a model of R&D-based growth in which the discovery of higher-quality products is governed by sequential stochastic innovation contests. We term the costly attempts of incumbent firms to safeguard the monopoly rents from their past innovations rent-protecting activities. Our analysis (1) offers a novel explanation of the observation that the difficulty of conducting R&D has been increasing over time, (2) establishes the emergence of endogenous scale-invariant long-run innovation and growth, and (3) identifies a new structural barrier to innovation and growth. We also show that long-run growth depends positively on proportional R&D subsidies, the population growth rate, and the size of innovations, but negatively on the market interest rate and the effectiveness of rent-protecting activities.

Keywords Schumpeterian growth · Scale effects · R&D · Innovation contests · Barriers to innovation

JEL Classification Numbers D2 · D7 · O3 · O4

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1 Introduction

Technological progress and innovation occur amidst uncertainty and insecurity. Incumbent firms with state-of-the-art production processes or products, for example, rarely remain unchallenged. Though patents afford them some protection, their past innovations are often claimed and captured by competitors through direct imitation, if not overt appropriation. As a consequence, their profits rarely remain intact over time and typically are eroded by further innovation. Thus, to protect their intellectual property and prolong the duration of their economic rents, incumbent firms may find it worthwhile to expend resources to frustrate imitation or to retard the pace of innovations by challengers.

The industrial organization literature has paid considerable attention to the above ideas primarily in the context of partial-equilibrium models and empirical studies. For instance, a growing body of research has been concerned with the nature, extent, and evolution of appropriability conditions regarding R&D, as well as with incumbent firm strategies to preserve their economic rents.\(^1\) Such strategies aim to limit the flow of knowledge spillovers to potential competitors and include investments in trade secrecy and camouflaging of their innovations through technological complexity of their products; expenditures in creating and maintaining legal teams to litigate disputes over patent infringements; choosing weak future competitors through strategic technology licensing.\(^2\) Besides delaying the introduction of new products, lengthy litigation (actual or potential) on patent infringement may deter the invention of similar or higher-quality products by competitors.\(^3\) In markets characterized by network externalities, where first-mover advantages are important, incumbent firms may use advertising strategically to improve customer loyalty, or expand manufacturing capacity and distribution systems to their advantage.\(^4\) Further, in the case of complex products like computers and other electronic

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1 Levin et al. (1987) and Cohen et al. (2002) identify and supply survey-based evidence on the extent of these activities.

2 Coca Cola has expended resources to maintain the secrecy of its formula; Microsoft has been adding new features to its Windows operating system, rendering it more complex and thus more difficult to imitate; and Intel has been producing increasingly smaller, more sophisticated and, arguably, more resistant to reverse engineering microprocessors. Rockett (1990) develops a model of patent licensing where incumbents choose weak (as opposed to strong) potential competitors in an effort to prolong their monopoly rights. He also presents case-study evidence based on the development and licensing of polyester, cellophane and nylon.

3 In his review of Baumol (1993), Pecorino (1995, pp. 390–391) states: “As for patent law, Baumol documents the fact that inventions are often met with costly and lengthy legal battles over patent rights. What is amusing and somewhat instructive is that Baumol’s examples run from Robert Fulton and Eli Whitney up through Henry Ford and Thomas Edison. Eli Whitney, for example, earned almost no return on the invention of the cotton gin and was involved in numerous infringement suits over a period of many years Baumol (1993, pp. 87–88). These examples indicate that the problem of excessive litigation is not an entirely recent phenomenon, and that the inventive spirit is not such a delicate flower as to be crushed by the legal difficulties which inventors typically face.” Lerner (1995) provides empirical support for the hypothesis that the patenting behavior of firms is affected by the presence of costly litigation. He shows that in the area of biotechnology firms with high litigation costs forego the opportunity to patent their products in subclasses populated by incumbents whose litigation costs are low.

4 Eisenhardt and Brown (1998, p. 8) provide several examples of time-pacing strategies (i.e., strategies that aim to expand manufacturing capacity in regular intervals independently of the pace of new product discoveries): “For example, about every nine months, Intel adds a new fabrication facility to its operations. According to Intel’s CEO Andy Groves, ‘We build factories