Chapter 14

Optimal Patent Design: 
An Agent-Based Modeling Approach

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ABSTRACT

Patents provide a patentee with a degree of monopoly power over a region of product space. The “breadth” and “duration” of patents are policy choices. Increasing patent breadth and duration will ceteris paribus increase the rent, which an individual inventor could earn from a commercially successful invention. However, the precise nature of the relationship between patent policy and the rate of societal technical advance, which is stimulated by a given patent design, is not well understood. In this chapter, the authors novelly investigate this issue using an agent-based modeling approach. The simulation results obtained raise questions about the real utility of patent policy in promoting technological advance and suggest that other policy instruments are actually more important.

1. INTRODUCTION

This study aims to enhance our understanding of the role of patent policy in the effective promotion of technological advance in a society. Understanding the process of invention (and how best to promote it) is important as the invention of new technologies and technological components impacts on social welfare. New products contribute to welfare through satisfying previously unmet needs or satisfying existing needs at lower cost. Despite the importance of technological invention, surprisingly little is known about the actual process of invention, as distinct from the processes of commercialisation and diffusion of inventions once uncovered.

Government policy-makers can plausibly encourage the supply of inventions by offering incentives to individuals and organisations. These incentives may include preferential tax treatment...
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of expenses incurred in undertaking Research and Development (R&D) (Czarnitki, Hanel, & Rosa, 2011), direct subsidy of R&D projects, and the granting of intellectual property rights such as patents to inventors.

A patent may be defined as a property right which creates a ‘right to exclude others from making, using, offering for sale, or selling or importing the invention’ (USPTO, 2005) in the territory covered by the patent legislation. Patents also provide a legal mechanism which allows the decoupling of the inventive process from the manufacturing process, permitting the creation of a risk-sharing structure as the created property right can be licensed to others. The interest in patenting by organisations and individuals is evidenced by the number of patents granted annually. For example, a total of 191,933 patents were issued in the United States in 2009 (USPTO, 2010). Prima facie, the number of patents that have been issued in various countries suggest that inventors value these property rights and are willing to incur costs to obtain them.

Despite the potential importance of patent policy for both society and individual organisations, our understanding of the affects of different patent policy choices on the rate of technological invention remains surprisingly limited. Maskus and McDaniel (1999) support this view, suggesting:

‘How patents affect invention, technology use, and growth remains an area of considerable controversy’ (p. 559)

This has led to practical difficulties in that limited guidance is available to policy-makers when deciding the appropriate scope of patent protection to offer to inventors. This poses a clear challenge to the research community. Accordingly, the broad research question addressed in this study is what is the effect of patent policy on the rate of technological advance in a society over time?

A particular problem of studies in this domain is that empirical studies of the effect of changes in patent policy do not take place in an otherwise ‘static environment’ rendering it difficult to unambiguously attribute cause and effect. Another challenge facing researchers in this area is that we have incomplete empirical data concerning the process of invention. Unsuccessful inventions leave few footprints on the sands of time and data sources such as patent databases form an incomplete record of inventive effort as not all inventions will be patented. Hence, it is difficult to gain complete insight into the inventive process by focusing solely on empirical data. This suggests that alternative methodologies can usefully supplement our understanding of patent design issues. In this study, we novelty adopt an agent-based modeling approach, which will allow the simulation of various patent policies in order to investigate their impact on the rate of technical advance in a society over time.

The rest of this chapter is structured as follows. Section 2 provides some background on the patent process and also provides a concise overview of some of the relevant economic literature on patent design. Section 3 describes the components of the developed agent-based simulation model along with the specific research hypotheses addressed in this study. Section 4 outlines the results of the simulation experiments and provides a discussion of these. The chapter is concluded in Section 5 with some suggestions for future work.

2. BACKGROUND

The patent system rewards innovators by granting them an element of market power. This naturally gives rise to two questions on the part of society (Wright, 1999):

1. How much monopoly power should be granted? and
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