

# Exploring the Patent Explosion

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**ABSTRACT.** This paper looks more closely at the sources of patent growth in the United States since 1984. It confirms that the increase is largely due to U.S. patenters, with an earlier surge in Asia, and some increase in Europe. Growth has taken place in all technologies, but not in all industries, being concentrated in the electrical, electronics, computing, and scientific instruments industries. It then examines whether these patents are valued by the market. We know from survey evidence that patents in these industries are not usually considered important for appropriability, but are sometimes considered necessary to secure financing for entering the industry. I compare the market value of patents held by entrant firms to those held by incumbents (controlling for R&D). Using data on publicly traded firms 1980–1989, I find that in industries based on electrical and mechanical technologies the market value of entrants' patents is positive in the post-1984 period (after the patenting surge), but not before, when patents were relatively unimportant in these industries. Also, the value of patent rights in complex product industries (where each product relies on many patents held by a number of other firms) is much higher for entrants than incumbents in the post-1984 period. For discrete product industries (where each product relies on only a few patents, and where the importance of patents for appropriability has traditionally been higher), there is no difference between incumbents and entrants.

**Key words:** ICT, market value, entry, intellectual property

**JEL Classification:** O340, L100, G240

## 1. Introduction

A number of researchers have explored the reasons behind the recent rapid growth of patenting worldwide and especially in the United States (Hall and Ziedonis, 2001; Kim and Marschke, 2004; Kortum and Lerner, 1995, 2003). Various explanations for the phenomenon have been offered: using aggregate U.S. and international

patent data, Kortum and Lerner attribute most of the growth to increases in innovation and, improvements in the management of R&D. Using data on U.S. firms during the 1983–1992 period, Kim and Marschke attribute the growth to increases in R&D in certain sectors as well as to increased patent yield in the computing, electronics, and auto sectors. Hall and Ziedonis study a single industry, semiconductors, where the patenting per R&D rate doubled over 10 years and find that the increase is associated with the assembly of large patent portfolios in order to forestall hold-up by rivals in the industry that own patents on technology that is necessary for the manufacture of semiconductor chips. Although there is no complete agreement among these authors as to the reasons for the increase, there is some consensus that the increase in patent yield is largely concentrated in computing and electronics, which suggests either that R&D has become more “fertile” in those industries or that something else having to do with patent strategy has changed.

The growth in patenting has also renewed economists' interest in evaluating the effectiveness of the patent system in promoting innovative activity among private firms. Although evidence on the effectiveness of patents for securing the returns to innovation is mixed (see the survey evidence reported by Cohen *et al.*, 2000 and the summary of empirical work in this area in Hall, 2003a), one area where patents are widely viewed as important if not essential is for securing the financing to start a new venture (e.g., see the evidence from semiconductor firms in Hall and Ziedonis, 2001). The current paper probes the empirical validity of this assertion by examining the comparative market valuation of patents held by incumbent and entrant firms in the United States during the 1980s, a period in which the use of patents by U.S. firms increased very substantially, partly as a

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result of changes in the enforceability of patents in the courts.

As several authors have demonstrated, the creation of a centralized court of appeals specializing in patent cases in 1982, together with a few well-publicized infringement cases in the mid-1980s, have led to an increased focus on patenting by firms in industries where patents have not traditionally been important, such as computers and electronics. In the first part of the paper I show that the decomposition of the sources of patent application growth in the United States supports the interpretation that the growth has been driven by increased patenting by U.S. firms in the electric machinery, electronics, and instrument industries, broadly defined. I also show that a time series analysis of patents reveals a very significant structural break between 1983 and 1984, one that was concentrated in the electrical sector, and more particularly, that firms in that sector (broadly defined to include electric machinery, electronics, instruments, computers, and communication equipment) increased their patenting across all technologies, accounting for essentially *all* the growth in patenting by U.S. firms.

Using a large sample of publicly traded U. S. manufacturing firms, I then investigate how their patent valuations changed between the early and late 1980s, focusing on the differences between incumbent firms and new entrants to the industry. I am able to confirm that after the mid-1980s, patents held by entrants to the publicly traded sector are indeed more highly valued than those held by incumbents. An industry decomposition of this effect shows that it is concentrated in what Cohen

*et al.* (2000) label complex product industries, which are industries where a single product can contain intellectual property covered by thousands of patents held by hundreds of patentholders. In such industries, patent portfolios often serve the defensive function of facilitating cross-licensing negotiations, rather than the traditional role of excluding competitors and securing the ownership of particular inventions. Although patent yield *per se* is not valued for incumbents in any of the industries, I show that in complex product industries there has been a strong positive shift in valuation for entrants as we enter the pro-patent era.

## 2. Changes in the U.S. patent system

A number of changes to the patent system, both legislative and via legal precedent, took place during the 1980s and more recently. These changes are summarized in Table I. A series of court decisions have expanded legitimate subject matter to include genetically modified organisms, software, and business methods.<sup>2</sup> Legislative changes have enhanced the ability of patentholders to enforce their patents, both via the creation of a specialized patent court, and via various procedural changes made at the same time. The Hatch–Waxman Act made patents even more important than they had been for pharmaceutical companies seeking to block generics from entering the market, by extending the lifetime of their drug patents to compensate for delays in regulatory approval.

Following these legislative changes, the demonstration effect of a series of infringement cases had a powerful effect on the thinking of some firm

TABLE I  
Major changes to the U.S. patent system

Year	Event or case	Result
1980	Diamond v Chakrabarty	patentability of artificially engineered genetic organisms
1980	Bayh–Dole legislation	increase in university patenting
1981	Diamond v Diehr	patentability of software
1982	legislation	Creation of CAFC; patent validity more likely to be upheld
1984	Hatch–Waxman Act	increased importance of patents for drug firms vis a vis generic producers
1985/6	TI sues Japanese semiconductor firms	wins suits; turns to suing U.S. semiconductor firms, funding R&D from licensing royalties
1986	Kodak–Polaroid	Decision on instant camera patent; final injunction against Kodak leading to \$1B judgment
1994	TRIPS agreement	harmonization drive begins
1998	State Street and ATT vs. Excel	patentability of business methods